ELECTRICAL REVIEW

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Our Expanding Industry

DURING what are known as the "inter-war" years the electrical industry in all its branches experienced a remarkable expansion. For all its tragedy and wastefulness war acts as a stimulus to science and industry and though the immediate aim is destruction peaceful applications of wartime developments help to accelerate social progress.

Again in the last war the electrical industry was called upon to increase production and devise new equipment and methods, and as a result further expanded in size and numbers. Thus since the last dinner of the British Electrical and Allied Manufacturers' Association was held in 1938 up to last week, when it re-established this important annual event, there has been tremendous growth. This is to be judged not only by the remarkable increase in the generating capacity of this country, culminating in the installation of over 1,000 MW of plant last year, but by the even more phenomenal expansion in the industry's overseas electrical trade.

At the B.E.A.M.A. dinner Sir George Nelson, the president, said that in the last twenty-five years our electrical exports had risen from £16 million to £180 million a year. He could have stressed that practically the whole of this increase had been achieved since the war, i.e., in about six years. It is true that depreciation of sterling makes the expansion appear to be far greater than it actually was, but it is still true that the volume is four times that of twenty-five years ago. For some time now as a consequence of this advance the electrical manufacturing industry has been the second largest exporting industry of the country, a fact emphasized both by Sir George Nelson and Professor Andrade, who proposed the toast of the industry at the B.E.A.M.A. dinner.

The B.E.A.M.A. can fairly claim to have played a large part in the expansion of the electrical industry's production and exports. By association the members have made the industry a strong one and have helped to bring about conditions in which it could flourish.

Government Departments look to the B.E.A.M.A. to guide them in measures designed to strengthen British industry as well as in necessary steps which may not be so beneficial. As a result it can be confidently hoped that when, as at the present time, scarce materials have to be apportioned, the "authorities" will recognize the electrical industry's just claim to prior consideration.

DIFFERENTIAL TARIFFS

Two letters published in this issue advocate different rates of charge for peak and off-peak electricity. But the methods of approach are different. One correspondent wishes to see a high "discouraging" rate for consumption during peak hours; the other wants consumption at other times to be fostered by a lower charge. In either case a timing device is called for and although one of the writers considers this to be more easily achievable than the installation of ripple-control apparatus, a good deal of expense in material and labour would be involved. The improvement of load factor is perhaps as desirable as peak cutting (the two go together of course) and the Electricity Boards may wish to do something about it when times are more propitious.

INDUSTRIAL LOAD SPREADING

There have been suggestions that as there has been little or no load shedding since the winter started, voluntary load spreading in industry has become unnecessary. Actually in Scotland it has been decided (subject to weekly review) to suspend load spreading. There are certain special considerations in the case of Scotland but they do not apply in England. The question naturally arises: To what extent has the avoidance of power cuts been due to industrial load spreading? If the answer is that it has been a major factor then the fallacy of suspending load spreading is clear. If on the other hand other causes have been mainly responsible, the cessation of an unwelcome and inconvenient system can be justified. But who is to make the assessment?

APPLIED RESEARCH

For the fourth year in succession the Regional Advisory Council for Higher Technological Education has prepared a list of applied research into electrical engineering that is in progress at colleges, both university and technical, within the London and Home Counties area. The list, although perhaps somewhat too concise, nevertheless does indicate the great variety of subjects being investigated in this way; copies are obtainable from the Council's offices in Tavistock Square, London. It is issued with the object of stimulating the undertaking of research of this kind, but the Council will go further and, when asked to do so, assist in the establishment of contacts between firms interested and the colleges concerned.

HYDRO ECONOMY

One of the problems of hydro-electric development, particularly in Europe, is that many rivers and lakes which are potential sources of power lie within the borders of two or more States. Their exploitation accordingly gives rise to complex legal problems and there are, in fact, many large schemes which are held up because of a conflict of interests, as shown in a study of the subject by Mr. P. Sevette, chief of the Power Section, Economic Commission for Europe. The Geneva Convention of 1923 which made an attempt to promote international agreement was ratified by only a few States no two of which possessed common frontiers. More recently the Committee on Electric Power of the E.C.E. has approved a number of recommendations. In view of the rapid growth of electrical demand in nearly all countries it rightly lays emphasis on the primary importance of technical considerations in the choice of sites.

FREE TRADE HALL

Special Electrical Features Incorporated in Rebuilding

IN December, 1940, bombs virtually destroyed the Free Trade Hall, Manchester, built in 1856 on the historic site of the Peterloo " massacre " of 1819. Only the main facades in Peter Street and the South Street side remained standing and these were considerably damaged. The recent completion of the rebuilding of this famous hall in about eighteen months at a total cost of about £450,000 is something of an achievement, particularly as apart from the restoration of the two elevations mentioned, the building has been completely re-planned to meet present day requirements and modern standards of amenity and equipment.

The main elements of the building are two halls, the Large Hall seating 2,560 with stage accommodation for a full symphony orchestra or 300 additional seats, and a Lesser Hall seating 425. Both are designed to suit concerts, public meetings, exhibitions, banquets, balls and cinema shows. As the Large Hall is in regular use for concerts (it is, of course, the home of the Hallé Orchestra) it is natural that special attention has been paid to acoustics and the city architect has been advised in that respect by Mr. Hope Bagenal, D.C.M., F.R.I.B.A. For public meetings and similar purposes the most modern E.M.I. public address system has been installed. The thirteen main loudspeaker units for this system as well as the high frequency units for the Compton electronic organ have been inset in the acoustic reflectors over the platform at carefully calculated angles.

The rebuilt Free Trade Hall, Manchester, showing Sir John Barbirolli rehearsing the Hallè Orchestra

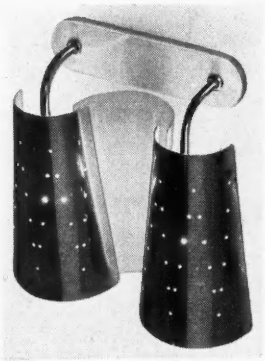
Also for the benefit of the audience at the back of the hall a delay unit has been provided so that the sound emitted from six loudspeakers, two situated under the circle and four under the balcony, is delayed, respectively, 50 and 90 milliseconds, thus allowing for the delay in the sound travel from the stage to the people underneath the circle and balcony. In this delay unit the sound is recorded on a continuous oxide film sprayed on the edge of a turntable and can be replayed up to 200 milliseconds later, the actual time being a function of the distance between the recording and replaying head, which is adjustable, and the table speed, which is constant. Facilities are also provided for the use of hearing aids in the end seats of certain rows both in the Large and Lesser Halls.

The nineteen loudspeaker groups and the hearing aid system as well as loudspeakers in dressing rooms, etc., and in the Lesser Hall (for overflow meetings), are fed from a power amplifier rack comprising eight 30 W amplifiers. Both the amplifiers and the delay units are situated at the back of the circle in the public address control room which also accommodates a control board embodying a double turntable assembly with two lightweight pick-ups and two meters. This control board is connected to the eighteen microphone positions on the stage, provision being made to use any eight of them simultaneously or more if grouped.

Special facilities are provided for radio and television broadcasts. Sound-proof control and recording rooms at the top of the building above the stage have been placed at the disposal of the British Broadcasting Corporation and are connected to an instrument room on the ground floor where ducts have been installed to permit rapid coupling up to mobile equipment outside the building. Intercommunication is also provided between the B.B.C. room, the Lesser Hall and the public address room.

In addition to four special B.B.C. microphone points on the stage, arrangements have been made, by the use of a connection point at the edge of the canopy and strain wires at the sides of the circle, for microphones to be suspended over the auditorium. Three 60 A sockets are available for television purposes.

Cue lights and buzzers (Standard Telephones) have been installed in all the dressing and other rooms used by performers and in most cases there are as well public address loudspeakers and telephones connected to the 50 line (Standard Telephones) automatic internal telephone system. For tuning musical instruments a Ferranti "A" note generator has been installed and connected with loudspeakers in the male and female orchestra rooms, male and female soloists' rooms, and in two positions on the stage. A Gent "Pul-syn-etic" impulse clock system has been provided throughout the building and also a fire alarm system incorporating thermostats and capillary tubes with direct alarm to the London Road Central Fire Station, installed by Associated Fire Alarms as sub-contractors to the main electrical contractors.



One of the decorative wall brackets used on the staircases, etc.

A striking feature of the lighting installation is that, contrary to usual modern practice, no fluorescent fittings are employed, tungsten lamps being installed throughout. For the main auditorium lighting Troughton & Young, Ltd., have supplied six specially designed chandeliers incorporating nineteen lamps arranged in a circle of twelve and a circle of six lamps at different levels with a single lamp in the centre at the bottom. Recessed ceiling fittings illuminate the balcony, and surface ceiling fittings have been used above the circle, with cove lighting underneath to illuminate the underside of the circle. For decorative effect, the fluted pillars at the side of the stage are illuminated at the base. A series of coats of arms round the walls is also illuminated from beneath.

The staircases are illuminated by rather unusual wall brackets manufactured by Troughton & Young made up of sheet metal shades in which small holes have been pierced for decorative effect. Attractive

A view of the auditorium of the Large Hall showing specially designed chandelier lighting fittings

The Lesser Hall *(left)* **is fully equipped with stage lighting.** *Right:* **Main refreshment lounge**

Public address delay unit

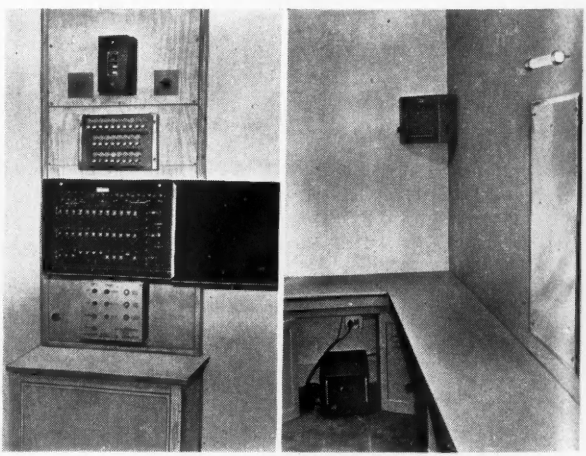
pendant bowl fittings (Merchant Adventurers of London, Ltd.) have been chosen for the refreshment lounge and louvred fittings of G.E.C. manufacture have been fitted in the artists' bar and lounge bar. All standards and dish fittings were made by Hailwood & Ackroyd, Ltd, and the working area bulkheads by Veritys, Ltd.

The stage lighting installation (Strand Electric & Engineering Co., Ltd.), provides for eighteen 1 kW acting area floods let into the canopy, together with two 1 kW spotlights. In addition, disappearing footlights are housed along the front of the stage in 3ft lengths with a total loading of 9·6 kW, and the sycamore panelling which forms the back of the stage is illuminated by a stage lighting batten concealed behind a canopy. Front-of-house lighting is obtained from two 2 kW spotlights concealed in the main ceiling, together with a four-colour pageant lantern with automatic remote controlled colour changing mechanism for dancing effects.

Dimming equipment for the stage and auditorium lights is situated in the dimmer bank room on the second floor and is remotely controlled from a board situated at the side of the stage, together with additional control points on the circle and in the projection suite. Control for cue lights and a Knight's fully automatic 20 cwt piano lift is provided at the side of the stage. This lift will also be used to support loudspeakers behind a collapsible cinema screen and for this purpose will rise 2ft 9in above the stage level. Control of the stage lighting in the Lesser Hall is carried out by a Strand directly-operated manual dimmer board. From the Lesser Free Trade Hall entrance a Wadsworth (15 person) passenger lift gives access to the Lesser Hall. The David McClure 30 h.p. 960 r.p.m. motor, which is fitted with an Ellison starter, is supplied with variable voltage through a Hewittic glass-bulb rectifier, a phase-shifting device being used to regulate the speed between 300 and 30 ft/min. Automatic levelling and gate opening and closing are provided.

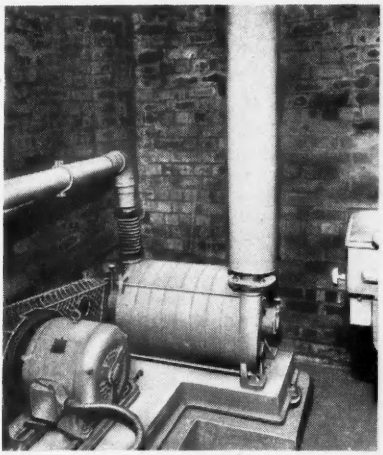
An all-electric kitchen is provided to facilitate catering when required; it is equipped with three Stott's combined hot-cupboards and hotplates (10 kW each) a

Stage lighting and cue board at the side of the stage and (right) Ferranti "A" note generator and loudspeaker in the male orchestra room



café set (12·2 kW), a Hobart dish washer (13 kW), a "Prestcold" 15 cu ft refrigerator and two Wadsworth 1 cwt service lifts, together with 3-phase and neutral 15 A socket outlets in circuits round the Main Hall to provide connections for hotcupboards. Stott café sets (12·2 kW) are also provided in the Main and Lesser Hall bars and a small Stott café set (5·5 kW) in the artists' bar. The caretaker's flat at the top of the building is also all-electric.

A plenum system installed by Saunders & Taylor, Ltd., of Manchester, is used throughout the building for heating and ventilating. A fully automatic gas-fired boiler equipped with Rheostatic control board and Negretti & Zambra remote temperature indication equipment, provides hot water for both the heating and most of the domestic hot water services; three Heatrae 20 gall thermal storage electric water heaters serve the lavatories. Bull 2 h.p. motors drive the water circulation pumps. The air washing and filtering plant, as well as the main inlet fan (Bull 30 h.p. motor) and a fan (Bull 7½ h.p. motor) extracting from low level in the Free Trade Hall, have been installed in the basement. The remainder of the extract fans are located in a penthouse on the roof, the main extract fan, high level, being remotely controlled from the basement, while the lounge bar extract fan is remotely controlled from the lounge. The whole system is thermostatically controlled by "Satchwell" instruments.



Central vacuum cleaning plant

The cleaning of the building is greatly facilitated by the availability of a Sturtevant built-in vacuum cleaning installation operated by a central plant situated in the basement. The 15 h.p. 1,450 r.p.m. motor which operates this is controlled by an Erskine Heap star-delta starter.

Public address control room showing amplifier racks and control board connected to the eighteen microphone positions on the stage

The Hall receives a supply from the North Western Electricity Board at 400 V 3-phase and neutral, feeding a 500 A circuit breaker for power and two 200 A circuit breakers for auditorium and stage lighting. The whole of the lighting where the public is present is controlled from one switchboard comprising an isolator switch for individual distribution boards, together with local switches controlling the individual circuits situated in a switch

room at the side of the Main Hall. The emergency lighting system, which incorporates Hart Accumulator Co.'s apparatus, comprises a 240 V battery of 240 Ah capacity at the 10-hour rate and designed for automatic change-over. All the switchgear, distribution and section boards, including main switch and control panels for both ordinary and emergency lighting, together with 25 V 25 W inspection light units used in the boiler house, etc., were supplied by Dorman & Smith, Ltd. C.M.A. p.i.l.c. single-wire-armoured cables were employed for the main distribution cables with v.i.r. cables of various C.M.A. makes in galvanized conduits for most of the sub-circuits, Pyrotenax cable being adopted for selected circuits throughout the building.

The rebuilding was carried out to the plans of the city architect, Mr. Leonard C. Howitt, B.Arch., F.R.I.B.A., whose electrical engineer, Mr. W. Sedcon, A.M.I.E.E., was responsible for the layout of the whole of the electrical equipment and installation, which was carried out by the electrical contractors, S. H. Heywood & Co., Ltd., of Manchester.

RESEARCH REPORTS

A WIDE range of topics is covered in the latest technical publications which have been made available by the British Electrical and Allied Industries Research Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey, at the prices indicated below.

Report Ref. G/T259 (price 7s 6d), by J. A. B. Horsley (Ministry of Fuel and Power), summarizes the results gained in intrinsic safety research up to the present date. The papers covered are S.M.R.E. Papers 104 and 106, and E.R.A. Refs. G/T232, G/T257 and G/T258. Both are concerned with the relation between the minimum igniting current and the circuit inductance; they record also the increase in the minimum igniting current that results when the inductance is shunted by resistance or capacitance, and the influence of the rate of break of the circuit and of circuit voltage. All the experiments were carried out with methane-air mixtures, containing, approximately, 8·3 per cent methane. Suggestions for grouping inflammables for intrinsic safety are given.

In Report Ref. L/T248 (price 15s), "The Zeeman Effect in Astrophysical Spectra: Bright Line Stellar Spectra," by C. E. R. Bruce, a study of data available on the spectra of bright line stars confirms the view that the emission emanates from electrical discharges in the stars' atmospheres. The law connecting the amount of line-broadening, or displacement, with wave length; the profiles of the lines, including the doublet and P. Cygni structures; the dependence of the line-profiles on the Zeeman patterns of the lines in question, in the great majority of the cases studied, are found to be in accord with the view that the phenomena are in the main the result of Zeeman and not Doppler effect.

Report Ref. L/T250 (price 9s), "The Static and Dynamic Rheological Properties of Dielectrics," by W. Lethersich, deals first with the strain/time relation for some dielectrics under constant stress, and completes tests described in the Association's report Ref. L/T171. The second part of the report concerns the measurement of dynamic modulus and coefficient of internal friction, or viscosity over a wide range of frequency. Tests covering part of this range have been described in report Ref. L/T212.

By the use of the impedance and admittance concept in Report Ref. L/T264 (price 7s 6d), B. Gross and H. Pelzer show that the electric network analogue of the visco-elastic behaviour of materials facilitates the interpretation of the relation between the spectra of retardation times and of relaxation times. In the limiting case when there is only a single time constant, i.e., if the spectrum degenerates into a single line, one is led incidentally to a new mathematical relation concerning the delta function. Although this relation is of a rather unorthodox type, it can be verified for two different special representations of the delta function.

The heat equation is solved in Report Ref. W/T22 (price 7s 6d), by H. Goldenberg, for the case of a homogeneous spherical object embedded in a homogeneous infinite medium with constant heat per unit volume per unit time generated in the spherical object only. The solution is subject to the restriction that both the spherical object and the medium possess equal thermal conductivities and diffusivities.

Curves are drawn showing the transient temperature at the centre of the spherical object, at the surface of the spherical object and at a distance from the centre of twice the radius. The transient temperatures at any points of the spherical object or of the medium may readily be calculated from expressions derived in the report, as, apart from material constants, these expressions involve only tabulated functions.

D.C.-Component Bias in Protective Gear

By R. K. EDGLEY,
M.Sc.(Eng.), A.M.I.E.E.*

Means of Ensuring Transient Stability

THE basic operating principles of most kinds of circuit protective gear are well known, but with the increasingly severe performance requirements that arise from the growing complexity of modern electric power systems new principles are being introduced and sometimes well-known principles are being applied in new ways. This article describes the use and application of d.c.-component bias to protective gear with a view to improving its transient stability.

One very useful application of this type of bias is to counteract the effects of the d.c. components of fault current on the stability of balanced protective systems (of the Merz-Price type) to external faults. The d.c. component that accompanies most fault currents has the typical form shown by the full curve in Fig. 1(a). If such a current is passed through the primary winding of a current transformer having a substantially resistive load, the secondary current will have a similar waveform, while the current-transformer core flux will be of the form shown by the dotted curve in Fig. 1(a). If the flux variation due to the a.c. component of current is superimposed on this, the flux waveform shown in Fig. 1(b) is obtained.

For a given value of fault current the peak-to-peak value of the alternating component of flux is constant, but the amplitude of the direct component is dependent on the decrement of the d.c. component of primary current and so it may depend on the position of a fault in a power system. With long decrements, the flux may increase above the saturation level of the current-transformer core, as indicated by the saturation line S in Fig. 1(b). The resultant magnetizing current is of the form shown in Fig. 1(c), it being assumed that magnetizing currents in the non-saturated region are negligible.

This fact is not of great importance provided that all current transformers are similarly affected, since it is modern practice in balanced protective systems to use only current transformers that have been balanced against a standard and therefore have reasonably similar characteristics, even in the saturated region. But it may be troublesome when the output of a current transformer passing the total fault current has to be balanced against that of several transformers which between them pass the total current, but which individually only pass a small proportion of it. This result may occur, for example, in balanced (restricted) earth-fault protection, when the neutral current transformer may pass the arithmetical sum of the three currents passed by the three line-current transformers; or in busbar-zone protection, when the total fault current may leave the protected zone by a single circuit, but be fed into the zone by several circuits in parallel. Both these types of protection may be applied close up to a generating source and so the likelihood of comparatively long-duration d.c. transients, with consequent saturation of the current transformer which passes the total fault current, is quite high.

When this happens the secondary current of the temporarily saturated current transformer is not a true replica of the primary current; it is in fact deficient, during the saturated period, by the amount of the magnetizing current. Consequently an out-of-balance current, equal to the magnetizing current, flows in the relay-operating circuit. Since even a small amount of saturation results in quite a large magnetizing current, the out-of-balance current may well be greater than the minimum relay-operating current, and so, unless steps are taken to prevent it, the relay may operate when there is a large, slowly decaying, d.c. component in the fault current.

It will be seen from Fig. 1(c), however,

*A. Reyrolle & Co., Ltd.

that the out-of-balance current is unidirectional. Under fault conditions, on the other hand, the relay-operating current is a.c. and so the two conditions are easily distinguishable. Thus, the transient stability of this type of protection is improved if the relay is relatively insensitive to d.c. energization, or if it is provided with d.c.-component bias.

This form of bias can also be usefully applied to transformer protection. A difficulty arises in the application of balanced protection to power transformers because of the magnetizing current surge that occurs when the transformer is energized, or when the applied voltage is suddenly increased (e.g., when the system voltage recovers after a fault is cleared). This surge appears to the protective gear as an internal fault. In the past it has been usual to time-lag transformer protection in order to allow the magnetizing surge to die down to a small amplitude before the protective gear has time to operate. This idea is not very acceptable to-day, however, since efforts are being made to cut down protection operating times as much as possible in order to reduce the amount of disturbance caused by faults.

When voltage is suddenly applied to a power transformer there is in general a direct component of core flux, as well as an alternating component, which is precisely analogous to the d.c. component of fault current referred to previously. Thus, if a transformer is switched in at an instant of zero voltage (corresponding to maximum flux) the first peak of the flux wave will have double normal amplitude, as shown in Fig. 2(a). Further to this, there may be some residual flux in the core, as a result of the way in which the transformer was last disconnected from the supply, and if this is additive to the prospective flux in the first quarter-cycle the direct component of flux will be increased by the amount of the residual flux. Thus the first peak of the flux wave may have nearly three times its normal amplitude. The direct component of flux decays exponentially according to the time-constant of the transformer magnetizing circuit and, at the same time, the flux wave returns to a symmetrical condition. The beginning of this decay is shown in Fig. 2(a).

It is usual to design power transformers so that the peak working flux at normal voltage magnetizes the core to a little below saturation level; and so the increase in flux because of the direct component just referred to drives the core well into the saturated region on alternate half-cycles. As a result, the magnetizing current taken in these half-cycles is very large and may well be a hundred or so times as great as the normal magnetizing current. In practice the first peak has a value of between two and seven times full-load current in average transformers; the smaller the transformer, the higher the relative value of the first surge-current peak. In the other half-cycles there is no saturation and so the magnetizing current is negligible. A magnetizing surge has the general waveform shown in Fig. 2(b).

The surge current obviously decays at the same rate as the direct component of flux. The time-constant of this decay is given by:—

$$T = \frac{X_m + X_s}{\omega(r_t + r_s)}$$

where X_m = transformer magnetizing reactance, X_s = source reactance, r_t = transformer winding resistance, r_s = source resistance and $\omega = 2\pi f$. In general, X_s is negligible compared with X_m and so the equation can be rewritten:

$$T = X_m/\omega\ (r_t + r_s).*$$

This reveals that the duration of a magnetizing surge depends upon the position

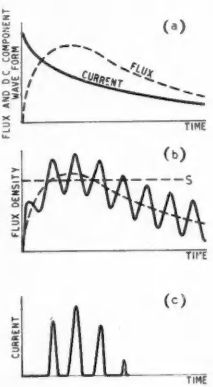


Fig. 1 (*left*).—**Typical waveforms—(a), (b), (c)**

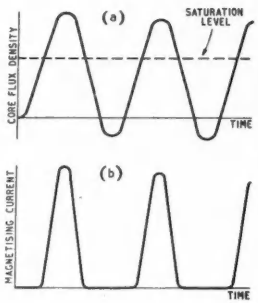


Fig. 2 (*below*).—**Flux and magnetizing current waveforms—(a), (b)**

* T is not in fact constant because of the variation in X_m due to saturation, but if the non-saturated value of X_m is used, a pessimistic result is obtained.

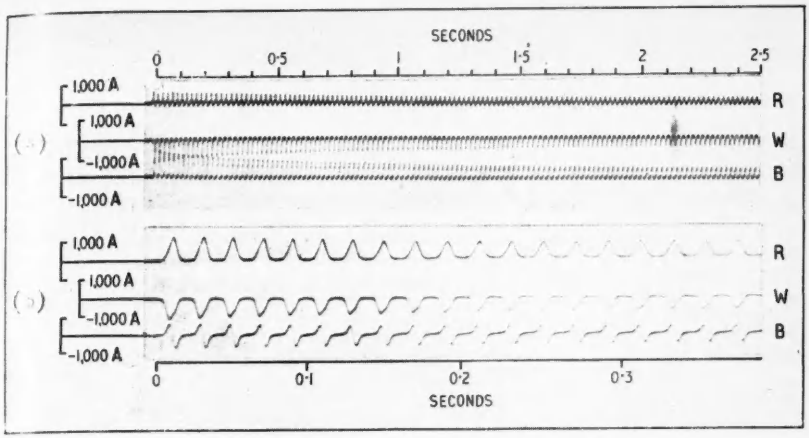


Fig. 3.—Transformer magnetizing-surge oscillograms

of a transformer in a power system, since it is dependent on the source resistance, but substantially independent of the source reactance.

It is not generally realized how long these magnetizing surges may last. Time-constants of the order of several seconds are not uncommon. One particularly severe instance is illustrated in Fig. 3(a); the equivalent time-constant, as measured from the oscillogram, is about 5 seconds and it is well over one minute before the magnetizing current decays to its normal value of 17 A.

The above description is particularly applicable to single-phase transformers, but it is equally so to the separate phases of three-phase transformers. There is one further consideration relative to core-type transformers, however. For a particular instant of switching, equal and opposite direct components of flux, and hence equal and opposite magnetizing surges, appear in two of the phases and there is no direct component of flux in the third phase. While the magnetizing current in this third phase is symmetrical, it is yet of high amplitude, because saturation of two limbs of the core cannot take place without causing saturation of the third. This effect, which is well illustrated by the oscillogram shown in Fig. 3(b), is important in connection with the application of protective gear.

Thus it will be seen that, with the one exception just mentioned, the magnetizing

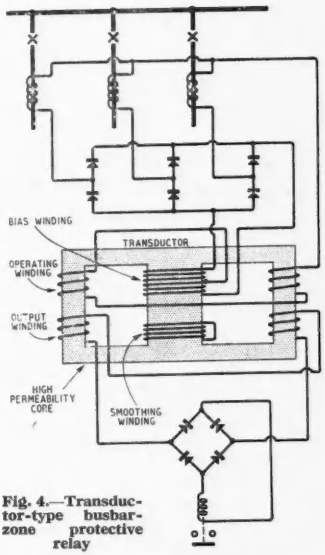


Fig. 4.—Transductor-type busbar-zone protective relay

surge of a power transformer is substantially unidirectional during the time that it is of high amplitude. Balanced transformer protection will therefore be unaffected by magnetizing surges if the relay is insensitive to d.c. energization, or if it is provided with d.c.-component bias.

The last-mentioned is most conveniently

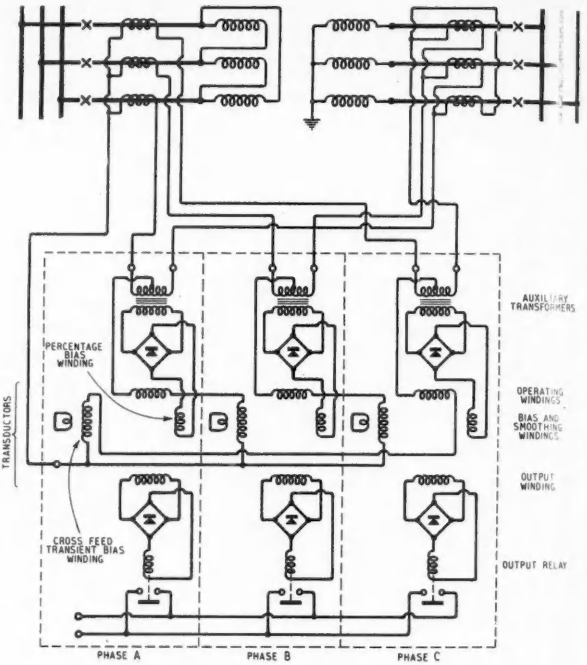


Fig. 4.—Transductor-type transformer protective circuit

applied by using a transductor-type relay. This type of relay is not widely known, but it is rapidly coming into use in many protective systems; the use of transductors as magnetic amplifiers may be more familiar to some. The transductor has been described in detail elsewhere[1,2,3]; furthermore the author and a colleague are in the near future presenting to the I.E.E. a paper on its application to protective gear.[4]

Briefly, as shown in Fig. 4, a transductor comprises a single-phase transformer with input and output windings wound on two limbs of a three-limbed core. On the third limb is provided a d.c. bias winding and a short-circuited smoothing winding. A simple telephone-type relay element is connected to the output winding. When there is no d.c. bias the transductor operates as a simple transformer and energizes the relay element. When current passes through the bias winding the whole core is saturated to some extent and the magnetizing current required to sustain any given voltage across the output winding is increased. Thus the *total* input current required to cause relay operation is increased. This arrangement can be used to provide a simple biased relay if the a.c. bias current, obtained in any well-known way by the protective system, is first rectified and then applied to the d.c. bias winding.

The transductor in Fig. 4 is shown in conjunction with a simple system of busbar-zone protection, for which it is particularly suited, since in this system the bias current is summated by means of rectifiers and therefore is already d.c. The relay is inherently insensitive to substantially asymmetrical currents, since the d.c. component of current in the operating winding causes sufficient core saturation, in conjunction with the saturating effect of the same current flowing through part of the bias winding, to prevent relay operation. Since out-of-balance currents of dangerous magnitude that occur during transient conditions are substantially 100 per cent asymmetrical, as explained earlier, this "auto-bias" effect is sufficient to ensure stability.

A similar arrangement can be used for transformer protection, except that in this instance bias current is obtained from an

[1] GALE, H. M., and ATKINSON, P. D.: "A Theoretical and Experimental Study of the Series-connected Magnetic Amplifier," I.E.E. *Proceedings*, 1949, Vol. 96, Part I, p. 99.

[2] LAMM, A. U.: "Some Fundamentals of a Theory of the Transductor or Magnetic Amplifier," A.I.E.E. *Transactions*, 1947, Vol. 66, p. 609.

[3] REYNER, J. H.: "The Magnetic Amplifier" (Stuart and Richards, 1950).

[4] EDGLEY, R. K., and HAMILTON, F. L.: "The Application of Transductors as Relays to Protective Gear," to be published in I.E.E. *Proceedings*, 1952.

auxiliary transformer, the primary of which is connected in series with the pilots and the secondary through a rectifier to the transductor bias winding. The operating winding is connected between the centre point of the auxiliary transformer primary winding and the neutral point of the current transformers. As before, this arrangement is sufficient to ensure stabilization against substantially asymmetrical currents, but it is not effective if one phase carries a substantially symmetrical surge current, as may happen. In order to provide for this eventuality a further bias winding, known as the "cross-fed transient-bias winding," is connected directly in series with the operating winding of a transductor associated with another phase, as shown in Fig. 5. Since it is magnetically linked with the short-circuited smoothing winding, it is unaffected by a.c. and is only effective by virtue of the d.c. component of current flowing through it. If the magnetizing surge in one phase is symmetrical, those in the other two phases will be asymmetrical and so stability of the protection is ensured.

Power Plant Production

Some O.E.E.C. Statistics

THE Organization for European Economic Co-operation (O.E.E.C.) has issued its third survey of the production of heavy equipment for power stations by member-countries—Germany, Austria, Belgium, the Netherlands, France, Italy, Switzerland, Norway, Sweden, Denmark and the United Kingdom.

Total "shipments" of generating plant with a unit capacity of over 10,000 kW by all these countries in 1951 is put at 9,305 MW. Shipments in 1952 are estimated at 10,413 MW, leaving an available "open" capacity of 1,810 MW. For 1955, on present indications, the shipments will be 2,241 MW, leaving an open capacity of 11,715 MW. The figures are analysed to show the proportions of alternators, turbines, boilers and transformers which make up the figures. It is also shown how the production is distributed between the manufacturing countries (home use), other O.E.E.C. members and non-members.

Tables are appended showing estimated deliveries from 1951 to 1955 and the estimated open capacity for 1952–55. According to the first table (1951) Germany was second to the United Kingdom in 1951 as a producer of power plant with deliveries as follows (very largely for home use):—Alternators, 10–40 MW, 620 MW; over 40 MW, 170 MW; steam turbines, 10–40 MW, 748 MW; over 40 MW, 168 MW; boilers, 45–180 tons/hr, 4,270 tons/hr; over 180 tons/hr, 1,340 tons/hr; hydro-electric alternators, over 10 MW, 60 MW; water turbines, over 10 MW, 541 MW; transformers over 5 MVA, 3,111 MVA.

For the United Kingdom the following 1951 figures are given:—Alternators, 10–40 MW, 922 MW (536 MW for export); over 40 MW, 874 MW (150 MW for export); steam turbines, 10–40 MW, 922 MW; over 40 MW, 874 MW; boilers, 45–180 tons/hr, 5,216 tons/hr; over 180 tons/hr, 431 tons/hr; water turbines and alternators, over 10 MW, 362 MW (240 MW for export); transformers, over 5 MVA, 3,950 MVA.

Another appendix indicates delivery periods for various items of plant as at 1st July, 1951. It shows that for the United Kingdom the period for turbo-alternators was 24–30 months (against 14–24 months in the case of Germany and 20–32 months for Switzerland). For boilers, hydro-electric sets and transformers the United Kingdom delivery period is shown as 24–42 months; Germany's was considerably shorter and Switzerland's slightly better than this.

Cement Making

WE have received from the Cement and Concrete Association, 52, Grosvenor Gardens, London, S.W.1, a copy of a 48-page technical brochure entitled "Cement in the Making." This well-produced publication tells in pictorial form the story of the manufacture of Portland cement, from raw material in quarry and claypit to the finished product sent out in bulk or in its paper bags all over the country. The story is reduced to diagrammatic form at the end of the book.

H.V. Measurements and Tests

Methods Discussed at I.E.E.

At a joint meeting of the Measurements and Supply Sections of the Institution of Electrical Engineers in London last week a discussion on high voltage measurements and tests was opened by Dr. J. S. Forrest and Dr. H. Tropper. The chair was taken by Mr. F. J. Lane, chairman of the Measurements Section, who was supported by Mr. R. Davis, chairman of the Supply Section.

The possibility of impulse tests displacing the traditional 50 c/s tests was referred to by most of the twelve speakers who took part in the discussion. The majority of them did not think that the traditional tests would be found superfluous, either by manufacturers or customers. It was noted that if only impulse tests had to be considered economies in materials and construction would become possible with some equipment, but one speaker observed that in the case of transformers the stress distribution at 50 c/s differed from that under surge.

E.R.A. Experiments

Duration tests at normal voltages, with regular measurements, were felt to give valuable information and some examples were quoted. One speaker expressed a preference for impulse rather than a.c. methods for puncture testing and explained how a.c. tests had in some cases given misleading results. The correct interpretation of discharge tests was discussed and one speaker considered them to be valuable and sensitive. An indication was also given of experiments which were being conducted by the E.R.A. and the results described related mostly to polythene and similar materials having low power factors. Such materials were amenable to accelerated tests conducted at frequencies up to 150 kc/s, which produced in 12 hours the effects of several years of service.

Referring to other experiments which had been carried out by the E.R.A., another speaker said that measurements at substations and automatic oscillograph records showed that at the terminals of 132 kV transformers the peak voltage encountered could attain 230 per cent of normal. This figure was reached when de-energizing the transformer and exceeded the value caused by any other occurrence, including lightning. Energizing gave a figure of 180 per cent.

The discussion of voltage dividers indicated a general preference for the capacitor type. One speaker adduced particular reasons for this preference when making tests with chopped waves, but an explanation was given of a method of compensating for errors by screening the capacitor divider by a high voltage electrode, thus distributing the voltage more equally along the divider and reducing the final error to within about 3 per cent. Another treatment described was by means of a network incorporating a feedback amplifier, so designed as to present infinite impedance of the voltage divider which could then be of the capacitor type. Such apparatus had been applied to bridge circuits to eliminate effects due to the stray capacitance of components.

Various speakers referred to experience gained in conducting tests and measurements, and spoke in favour of the use of instruments at low voltage rather than direct reading high voltage methods. The importance of screening was emphasized and the use of thermo-couples was compared with resistance methods of measuring temperatures. For the rapid measurement of peak voltage a sphere gap was mentioned with the suggestion that it might be irradiated by employing the radio-active materials now available.

Battery Guide

A 16-page technical brochure which has just been issued by the Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7, is principally intended as an aid to teachers in schools and technical colleges when dealing with the subject of primary cells and batteries. It is clearly written and well illustrated and is available free of charge to headmasters, who can obtain further copies at a nominal charge of 1s each.

VIEWS on the NEWS

By REFLECTOR

RECENTLY I reported, with approval, that some members of the Tunbridge Wells Branch of the Electrical Contractors' Association had said that they declined to install outlets for electric dry shavers in bathrooms. I suggested that there were plenty of earth-free situations in a house in which these implements could be used. I am pleased to see that the E.C.A. thinks the same for in a letter to members, the director (Mr. L. C. Penwill) advises them to refuse to install outlets in bathrooms. As he points out, the I.E.E. Regulations specifically provide that no provision shall be made for the use of portable appliances in a room containing a fixed bath.

* * *

A Washington report says that "lie detection" apparatus has been set up experimentally at the Oakridge, Tennessee, atomic energy plant. Its purpose is to make periodical tests on employees in "critical positions" to ensure that they are not giving away any secrets of the plant. Strangely enough it is being used only with the employees' consent and even then the department does not regard the results as conclusive. The action seems to be psychological rather than electrical, because it was stated by a spokesman of the Atomic Commission that "when a man knows he is going up against this machine he thinks about it when he starts talking."

* * *

In a television discussion last week the virtues of solid fuel (burned in a proper stove) and the vices of electricity (and to some extent gas) were again brought out. Mr. A. R. Cooper, controller of the B.E.A.'s North Western Division, did his best to hold up the electrical end but he had little chance against the coal industry's representative. Official policy backs the new solid fuel appliances and no doubt there is much to be said in their favour. It is still true, however, that they (and the gas industry) need better coal than that which power stations can use and that the public cannot get it anyway. Until coal is made available the public will continue to use electric and gas fires at the wrong time of day.

* * *

I have heard from Mr. A. L. Burnell, secretary of the South Eastern Electricity Board, on the subject of meter cards to which I referred last week. He says that I was right in surmising that the old Brighton card was a very small one. He has pointed out in a letter to the Brighton *Evening Argus* that the new cards represent an economy because (*a*) they enable the collector at once to do the analysis formerly made in the office and (*b*) they last longer and so reduce the work of issuing new cards.

* * *

I am thinking of starting a collection of enigmatical newspaper headlines and might begin with one in a recent *Daily Graphic*—"Log-blaze Landladies Shed the Power Load." The report thus introduced relates to a scheme of the Great Yarmouth Landladies' Hotel and Boarding House Association to hold their weekly meetings in turn at one of the member's premises, enabling fires to be switched off in the other establishments for a couple of hours. The decision was taken at a gathering before a log fire at a Yarmouth hotel.

* * *

Electricity as a matrimonial agent is a new idea. As reported by the *Daily Mirror*, a young Welsh farmer recently told a conference, called to consider supplies of electricity to rural Wales, that he and his kind are "playing second fiddle in the matrimonial stakes to young men in town jobs. Country girls prefer to marry town men because they know they will live in houses that have electricity to make housework easier." They saw no hope of marriage until the farms had electric power and light. This, I think, is a very strong additional argument in favour of speeding-up rural electrification.

PERSONAL and SOCIAL

News of Men and Women of the Industry

TO fill the vacancies caused by the retirement of Lord Riverdale, **Mr. E. W. Smith,** Ph.D., B.Sc., M.I.E.E., has been appointed to the boards of the Telegraph Construction & Maintenance Co., Ltd., and its subsidiary, the Selborne Plantation Co., Ltd.

Dr. E. W. Smith

A director of Submarine Cables, Ltd. (owned jointly by Telcon and Siemens) since 1947, Dr. Smith is one of the leading authorities on world submarine telegraph and telephone cables. He has been with the Telcon organization for forty-two years, formerly as chief electrician and latterly as manager. Dr. Smith, who joined the company in 1910 at the age of sixteen, served from 1916-1918 in India and with the Aden Field Force, having obtained a commission in the Royal Artillery. In 1926 he accompanied the expedition to lay the Cocos-Perth loaded telegraph cable, primarily for the purpose of conducting research on the cable after it was laid. Similar work in connection with the Pacific loaded cable took him later in that same year to Vancouver. He was also with the expedition to Newfoundland which laid the first duplex loaded cable in 1928. It was this research work which provided him with the material for the thesis which gained for him the degree of Ph.D. of the University of London. He subsequently went to Tenerife in 1929 in connection with research on coaxial telephone cables, presenting a paper on this subject to the Institution of Electrical Engineers on his return.

Mr. W. Findlay, B.E.M., until recently a Glasgow district manager for Hoover, Ltd., has been appointed Midland branch manager for the company with headquarters at Birmingham.

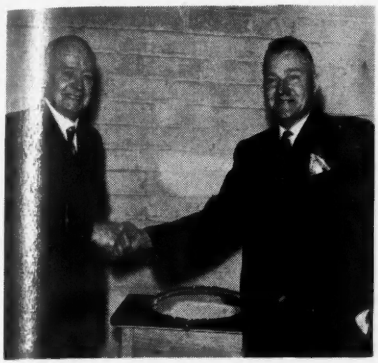
Mr. K. S. Davies, B.Sc., A.M.I.E.E., director of engineering, Murphy Radio, Ltd., was elected chairman of the Radio Communication and Electronic Engineering Association for the ensuing year at the annual general meeting in London on 18th January. Mr. Davies, a native of Monmouthshire, received his technical education at the Universities of Wales and Cambridge and was with Standard Telephones & Cables, Ltd., before joining Murphy in 1933. The new vice-chairman is **Mr. C. G. White,** director and general manager, marine division, Kelvin & Hughes, Ltd. He is a member of the Honourable Company of Master Mariners and has been president of the British National Instrument Trade Association for three years. The Council of the Association was re-elected.

Marryat & Scott, Ltd., announce the appointment of **Mr. R. Walker** and **Mr. B. P. Hutton** as directors of the company. Mr. Walker has been secretary of Marryat & Scott, Ltd., since 1928 and is also secretary of the recently formed public company, Marryat & Scott Holdings, Ltd. Mr. Hutton joined the company in 1932 and since then has been connected with sales and advertising in London and Birmingham, and as sales manager since 1945.

Mr. M. V. Ely, chairman of Foster Transformers & Switchgear, Ltd., and Foster Electrical Supplies, Ltd., and a director of Lancashire Dynamo Holdings, Ltd., and A. Roberts & Co., Ltd., whose name we inadvertently omitted from our list of those who appeared in the New Year Honours, became a C.B.E. He founded the Foster Arc Lamp Co., the forerunner of the companies of which he is now chairman. For a long time his main interest outside the electrical industry has been hospital work, and among his activities he has for eighteen years been a governor of King's College Hospital, of which he is also vice-chairman of the Medical Council. He has a long association with the National Heart Hospital and the Sutton and Cheam Hospital, and during the war he was one of the three controllers appointed to the Emergency Military Hospital at Leatherhead.

Mr. M. V. Ely

Mr. W. Donovan, chairman of the Donovan Electrical Co., Ltd., recently celebrated his eightieth birthday, and to mark the occasion the employees have presented him



Mr. W. Donovan, chairman of the Donovan Electrical Co., Ltd. (left) receiving a presentation on his eightieth birthday

with a silver salver. The accompanying picture shows Mr. H. Bosworth, who has forty-five years' service with the company, making the presentation.

Mr. J. Burbridge, head of the electrical engineering department of the Leeds Corporation Transport, is retiring after forty years' service.

In responding to the toast to the company at the annual staff dinner and dance of **Radiovisor Parent, Ltd.,** Mr. E. Harley Bell, managing director, traced its history from its early pioneer work in the electronic field in 1927 to the present day. From humble beginnings great progress had been made, and with emphasis laid on the word " Parent " in the title this was no formal occasion but a family party with friends and guests.

Mr. W. E. Gibbs, M.I.E.E., has been appointed engineer-in-chief to the South Eastern Electricity Board in succession to **Mr. W. A. Gallon,** whose resignation was announced recently. He previously held the position of deputy engineer-in-chief to the Board. Mr. Gibbs was born at Maidstone in 1900, received his early technical training at Battersea Polytechnic and joined the former County of London Electric Supply Co., Ltd., as a student in 1918. He subsequently became an assistant engineer in the mains department covering the London, Surrey and Essex areas and served successively as technical assistant, transmission superintendent, supervisory control engineer and assistant superintendent electrical engineer in various areas controlled by the County of London group. In October, 1945, he was appointed regional manager for the South West region of the group, the region covering a large part of South East London and parts of East Surrey. On 1st April, 1948, when the industry was nationalized, he became deputy engineer-in-chief to the South Eastern Board.

Mr. W. E. Gibbs

The annual staff dinner of **F. Westerman (Wholesale), Ltd.,** was held at the Grand Hotel, Birmingham, on 5th January. Mr. F. Westerman, chairman and managing director, praised the staff for their good work and Mr. H. E. Bagnall proposed the toast of the company. The toast to the visitors was proposed by Mr. D. Bradnick and Alderman W. Lewis responded.

The Minister of Fuel and Power has appointed **Mr. Arthur Bond,** secretary and solicitor of the Eastern Electricity Board, to be deputy chairman of the Yorkshire Electricity Board. Mr. Bond, who is forty-four years of age, was born at Darwen, Lancashire, and after being articled with Mr. H. D. Holland, solicitor of that town, was admitted a solicitor in 1929. He entered the local government service in 1930 and after holding appointments at Cleethorpes, Macclesfield and Luton, was appointed Town Clerk of Macclesfield in 1938 and later became Town Clerk of Stockport. He was appointed secretary of the Eastern Electricity Board in January, 1948. Mr. Bond married the eldest daughter of Mr. T. Wadsworth of the B.T.H. Research Laboratories in 1935.

Mr. A. Bond

On Friday last the Long Service Association of **Elliott Brothers (London), Ltd.,** held its annual dinner at Pynes Restaurant, New Cross. Mr. W. Phillips, M.I.E.E., president of the Association (fifty-five years' service), presided. Members were received by Mr. R. E. F. de Trafford, O.B.E., chairman of Elliott Brothers, and Mr. L. Bagrit, managing director. Mr. J. E. Coales, O.B.E., M.A., director of research, and Mr. E. O. Herzfeld, secretary, were also present.

The toast to the company was proposed by Mr. F. C. Leonard, M.Inst.F. (thirty years' service), a senior technical officer of the company. Mr. de Trafford, in responding, said that Elliott Brothers were now in the forefront of the instrument industry and this was due in large measure to the loyalty and support he and his colleagues had always had from employees. Mr. L. Bagrit said that the

company looked to the members of the Association to lead with their experience and guide with their skill the many younger members of the organization. Mr. E. J. Harper (40 years' service) proposed the toast of the president, and Mr. W. Phillips replied.

Mr. J. W. E. Rutherford, managing director of **Adamson & Co. (Tyne), Ltd.**, presented long-service awards to members of the staff with ten, fifteen and twenty-five years' service when the annual staff party was held recently at the Springfield Hotel, Newcastle-upon-Tyne.

The annual New Year party of the **Marconi Instruments Social and Sports Club** was held in Watford Town Hall on 21st January. Some 600 members and friends attended and danced to the Frank Harwood Orchestra. Games and competitions added to the gaiety of the evening.

Mr. I. O. Stewart has been appointed branch manager of the Edinburgh sales office of British Insulated Callender's Cables, Ltd., as from 1st January, in succession to the late Mr. J. H. Dinwoodie. Mr. I. O. Stewart was educated at the Melrose and Edinburgh Academies and the Heriot-Watt College and joined the former British Insulated Cables, Ltd., at Glasgow in 1934. He was appointed to the Edinburgh Branch in 1936. During the last war he was works engineer at the Ministry of Aircraft Production factory at Corstorphine.

Mr. I. O. Stewart

The annual dinner and staff party of **Hurseal, Ltd.**, was held recently at Verry's Restaurant, Regent Street, London. After dinner, Mr. A. C. Hazel, managing director, and the rest of the staff moved down the street to continue an enjoyable evening at Hurseal's new basement showrooms.

The annual **E.D.A. Carnival** was held at the Oxford Galleries, Newcastle-upon-Tyne, on 18th January, when 1,000 members of the industry attended. The guests were received by Mr. J. C. Arkless, F.C.I.S., director and secretary, A. Reyrolle & Co., Ltd., and chairman of the Electrical Industries Benevolent Association, Northern Counties Area, and Mrs. J. C. Arkless. The Carnival has been held since 1927, and has now become one of the outstanding events in Newcastle. As a result of past Carnivals the E.I.B.A. has received £4,750, and the proceeds from this year's

Mrs. K. C. West presenting a bouquet to Mrs. J. C. Arkless at the E.D.A. Newcastle Carnival. On the left is Mr. Arkless and on the right Mr. A. Parkin

Carnival will bring the total to over £5,000. The Organizing Committee for the Carnival were Messrs. S. G. Pike (chairman), C. Gray, L. Mellor, H. Ord and A. Parkin.

The company dinner of the **Express Lift Co., Ltd.**, was held on 11th January. Mr. V. Amberg, managing director, was in the chair and Sir Harry Railing, chairman of the G.E.C., and Lady Railing were also present. The toast of the company was proposed by Mr. H. W. Watson, an employee, who said that one in every five employees had completed twenty-one years' or more unbroken service with the company, which he regarded as a fitting tribute to the co-operation and team spirit between staff and management and workshop and offices. The great asset of team-work was also stressed by Sir Harry Railing, who responded to the toast. A short cabaret followed the dinner, which was attended by some 500 guests, including the Mayor and Mayoress of Northampton. Later

Mr. V. Amberg, managing director of the Express Lift Co., Ltd., speaking at the company dinner

in the evening Lady Railing presented prizes to successful sports contestants who competed in various activities arranged during the year by the Abbey Works Sports Club.

OBITUARY

Mr. J. W. Hadfield.—The death occurred on 12th January at the age of seventy-nine of Mr. Joseph Wilfred Hadfield, former borough electrical engineer of Barnstaple, a position he held for thirty-five years until his retirement in 1937.

Mr. J. W. Porter, assistant general manager of W. T. Glover & Co., Ltd., and a freeman of the City of London, died suddenly at his home at Sanderstead, Surrey, on 24th January. Mr. Porter joined the company in 1910 and was appointed manager of the London office in 1924. He became joint sales manager in 1946 and was promoted assistant general manager in January, 1950. During the 1914-1918 war he served in the Royal Navy. Mr. Porter was a member of the Batti-Wallahs' Society.

The late Mr. J. W. Porter

Mr. Taylor Croft, who until his retirement in 1946 was a director of Contractors (Pudsey), electrical engineers, has died at the age of sixty-eight.

Mr. Joseph Harvey, an electrical engineer with Bedford Corporation for forty-three years, died on 22nd January at the age of seventy-nine. He had been retired since 1938.

Mr. C. H. Phillips, late of the Sun Electrical Co., Ltd., died at Southlands Hospital, Shoreham, on 15th January at the age of seventy-five. Mr. Phillips joined Sunco in 1918 and retired in 1944.

Mr. John Leo Williams, assistant accountant to the Midland Electricity Board, has died at Stourbridge at the age of sixty-two. He was formerly with the old Electric Light Co., at Ventnor, Isle of Wight.

WILLS

Mr. G. C. Chelioti, a director of the General Electric Co., Ltd., and associated concerns, who died on 27th September last, left £25,301 gross (£23,802 net).

Alderman A. Hewitt, O.B.E., D.L., J.P., formerly for nearly twenty-five years chairman of the North Wales and South Cheshire Electricity Authority, who died on 16th September last, left estate "so far as can at present be ascertained" valued at £35,348 gross (£29,717 net).

Mr. H. S. Seccombe, chairman and managing director of Electrical Components, Ltd., who died on 7th October last, left £97,615 gross (£91,279 net).

Mr. W. C. Gould, director and secretary of the Southern Areas Electric Corporation, Ltd., who died on 20th July last, intestate, left £9,764 gross (£7,849 net).

Mr. W. H. Flear, property manager, secretary's department, London Electricity Board headquarters, who died on 27th September last, left £2,985 gross (£2,898 net).

Mr. N. S. Sim, A.M.I.E.E., of the English Electric Co., Ltd., Stafford, who died on 12th May, left £15,948 gross (£15,869 net).

Mr. C. C. Howis, manager of the chemical research laboratory of British Insulated Callender's Cables, Ltd., Kirkby, who died on 21st September, left estate "so far as can at present be ascertained" valued at £2,366 gross (£2,261 net).

Dr. Ernest I. Watson, formerly chairman of Heatrae, Ltd., who died on 28th April, left £41,050 gross (£39,442 net).

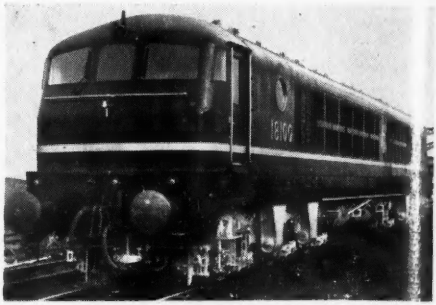
Chancellor's Statement

IN the House of Commons on Tuesday the Chancellor of the Exchequer (Mr. Butler) made his promised statement on measures for dealing with the economic situation. He said that it would be necessary to impose further cuts on imports amounting to £150 million, making with those announced in November a total of £500 million. There would be tighter control of all types of non-essential building work using steel; supplies of steel for buildings, machinery and vehicles would be reduced by a sixth of the 1950 amount. The Chancellor announced that Budget day would be 4th March.

Equipment for Brazil

THE importance of Brazil as a market for British products is stressed in an article by H.M. Minister (Commercial) at the British Embassy, Rio de Janeiro, in the *Board of Trade Journal* of 26th January. In this reference is made to electrical developments, which have already been reported by our Rio correspondent. Among the principal imports given in a table in the article are electric motors and generators; a value of 195 million cruzeiros is given for the first six months of 1951, compared with 296 million for the whole of 1950. Corresponding figures for equipment for electrical installations are 89 million cruzeiros and 103 million. These two groups are classified as essential imports.

Gas Turbine Electric Locomotive



Many Operating and Financial Advantages Claimed

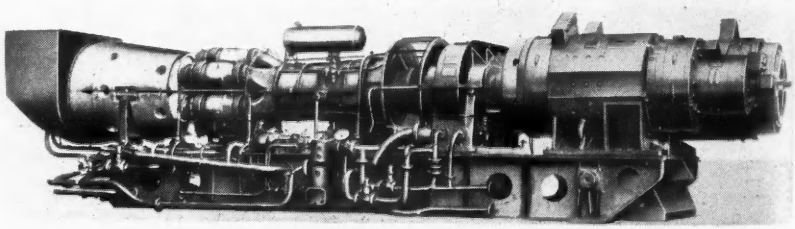
ON Tuesday of this week we inspected at Paddington Station, London, the gas turbo-electric locomotive No. 18100, which has been designed and built for British Railways by Metropolitan-Vickers Electrical Co., Ltd. This locomotive is an experiment entered into by the Great Western Railway and carried forward by the Railway Executive under the direction of Mr. R. A. Riddles. The financial and technical responsibility for the project is shared by British Railways and the manufacturer.

The principal features were determined by the service requirements stipulated by the then chief mechanical engineer of the Great Western Railway. These requirements were that it should be suitable for hauling the heaviest passenger trains on the Western main routes, particularly that between London and Plymouth, and at speeds up to 90 m.p.h.

To work such trains satisfactorily over the heavy gradients (up to 1/36) at the western end of the main route it is necessary to provide a maximum starting tractive effort of the order of 60,000 lb and, with the stipulated maximum axle loading, that requires six driving axles. The same considerations led to fixing the continuous rating at 30,000 lb tractive effort. Electric transmission was adopted as the only practicable and reliable means of satisfying these conditions.

The selection of the nominal rating for the power unit was based on these and other considerations, and the power available is more than adequate to give the timings required by the Western Region. The locomotive builders were anxious that this new power unit should be of a type readily applicable to overseas railways where heavier duties might be involved and where derating might be imposed by unfavourable ambient temperature and altitude. A nominal output of 3,500 h.p. at the turbine coupling was therefore selected and the design of turbine, reduction gear and electric transmission equipment was based on that figure although the blade profiles in

Side view of power unit, including combustion chamber, turbine compressor and generators on the bedplate



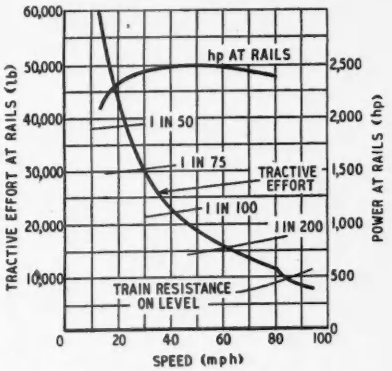
the present machine limit the continuous output to between 3,100 and 3,200 h.p. Should the full nominal output be required in the future it can be made available by changing certain of the existing blades for new ones of slightly different profile.

The body structure of the locomotive contains the power plant and a driving cab at each end. It is carried on two bogies by swing links which are resiliently attached by rubber universal joints to permit controlled swing bolster action and bogie pivoting. Each bogie has three driving axles each driven through a single reduction gear by a traction motor suspended on the axle and from a support on the bogie frame.

A simple open cycle gas turbine without heat exchanger is the prime mover and the cycle of compression, heating and expansion of the air is carried out in a compressor, combustion chamber and turbine arranged in line and built into a single straight through unit. The compressor is a 15-stage axial-flow machine with a pressure ratio of 5·25 at 7,000 r.p.m. and a mass flow of 50 lb/sec; it runs in two sleeve type bearings. The turbine is a five-stage unit also running in two sleeve type bearings and its rotor is directly coupled to that of the compressor.

The turbine drives three main traction generators at 1,600 r.p.m. through single reduction gearing. The reduction gear unit has two output shafts; one drives two of the main generators in tandem and the other drives the third main generator, the auxiliary generator and the exciter. The turbine, reduction gear and group of generators are mounted on a common bedplate together with the main fuel and lubricant pumps and constitute a self-contained power unit which is installed in the locomotive body on three support points on its main underframes. The self-ventilated, six-pole, d.c. main generators have continuous ratings of 1,100 A, 666 V, 1,600 r.p.m., the one hour ratings being 1,250 A, 580 V, 1,600 r.p.m. The auxiliary generator and exciter are also self-ventilated d.c. machines. The former has six main poles and interpoles and is shunt excited under the control of a voltage regulator to give 110 V irrespective of load and the turbine speed. Its continuous rating is 65 kW, 110 V, 1,280 r.p.m. The exciter has a continuous rating of 10·5 kW at 55 V over a speed range of 1,280 to 1,600 r.p.m.

Each of the three main generators

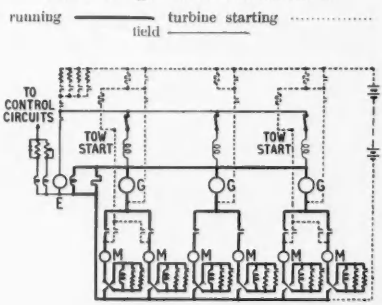


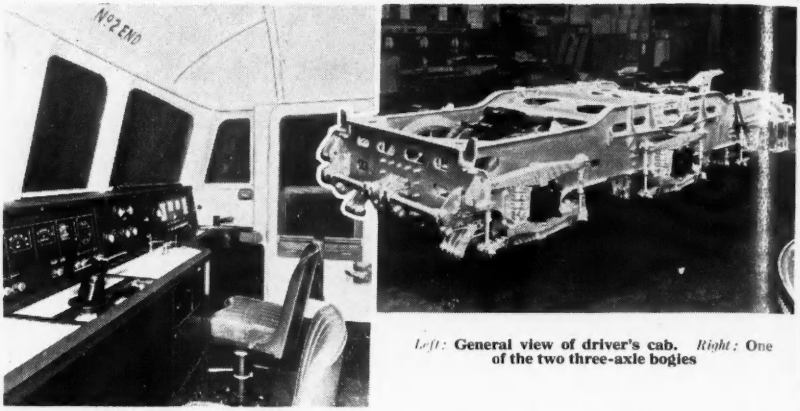
Locomotive performance diagram. Turbine output 3,000 h.p., generator input 2,850 h.p., auxiliary load and gear loss 150 h.p. Weight of train (18 coaches) 650 tons, locomotive 130 tons, total 780 tons

supplies two of the six traction motors, the motors of each pair being connected permanently in parallel. They are separately ventilated, four-pole and series interpole machines with continuous ratings of 550 A, 666 V, 706 r.p.m. (33·5 m.p.h.) and one hour ratings of 650 A, 565 V, 580 r.p.m. (27·5 m.p.h.).

The drive of the axle is by single reduction spur gearing of 21/58 gear ratio, 2·066 diametral pitch. The gear wheel incorporates torsional resilience, the rim being separate from the centre but mounted on it through the medium of a series of rubber bushes which permit a small relative torsional movement. This cushions the transmission of shocks from rail to motor armature, particularly at rail joints, and

Basic arrangement of traction circuit





Left: **General view of driver's cab.** *Right:* **One of the two three-axle bogies**

reduces the corresponding stresses in rails, gear teeth, armature shaft and other armature parts, and contributes to better riding of the vehicle as a whole and to reduced maintenance.

At the cost of some elaboration of apparatus the control scheme has been designed to require from the driver the minimum of concern and responsibility for the functioning of the power plant and auxiliaries. The locomotive can be ready for service after about five minutes warming period if the start has been from cold. To move the locomotive, either light or with its load, the brakes are released, the reversing lever of the master controller moved to the direction required and the power lever set to the position required. This lever has no notched positions but can be set and left at any position between no power and full power. The same lever determines the starting tractive effort developed between the minimum for light locomotive manœuvring and the maximum determined by wheel slip consideration. The driver is not required to notch up this lever as the train speed rises; he may do so if he wishes but may equally well put it directly in the position he expects ultimately to require.

In the main power circuits the apparatus used is the same as for an electric locomotive. For example, each traction motor is controlled and protected by an electro-pneumatic unit switch, and its field is reversed by an electro-pneumatic drum switch. The auxiliary circuits also are controlled by conventional electric traction apparatus but on the other hand in the subsidiary control and regulating circuits new conditions are encountered and special devices have been designed to deal with them. For instance, the principal components of the master controller are low voltage potentiometers. Their function is to apply to servo devices in the control circuits voltages proportional to the response required by the position in which the driver has placed the controller lever. These servo devices are of the vibrating contact type and they control field strengths and servo motors to produce the desired result.

Most of the auxiliaries are electrically operated from the 110 V d.c. supply from the auxiliary generator. The battery, consisting of 48 lead-acid cells of 384 Ah capacity, is charged from this supply through a contactor which is closed only when the auxiliary generator is operating. Certain of the electrical auxiliaries are " battery fed " and can be run at any time while the others are " generator fed " and can be run only when the turbine is running.

From the turbine output of 3,000 h.p. an allowance of about 150 h.p. provides for the loss in the reduction gear and the demands of the locomotive auxiliary equipment, leaving 2,850 h.p. input to the traction generators. Over most of the speed range of the locomotive an electric transmission efficiency of about 86 per cent is achieved, corresponding to 2,450 h.p. at the rails. This power is sufficient to give an 18-coach train balancing speeds of 85 m.p.h. on the level, and 41 m.p.h. and

23 m.p.h. respectively when climbing gradients of 1/100 and 1/50.

A turbine full load thermal efficiency of 19 per cent has been demonstrated on test; when account is taken of the gear and electrical losses, the overall thermal efficiency of the locomotive becomes 16 per cent. After deduction of the 75 h.p. required for auxiliaries, the remaining traction power available at the wheels represents 15½ per cent of the heat value of fuel consumed, or a fuel rate of 0·81 lb/h.p. hr. At half power this rate will rise to about 1·3 lb.

The fuel tank has been designed to hold sufficient gas oil for the London–Plymouth run hauling the maximum tonnage trains, with a considerable reserve. It carries also the corresponding quantity of gas oil for the train heating boiler on the same run, and another section of the tank accommodates the water supply for the train heating boiler on the same basis. The two sections can readily be employed as a single fuel tank to give a 60 per cent increase in fuel capacity.

The case for using this type of locomotive in preference to steam traction rests mainly on economies from its higher efficiency and anticipated lower maintenance costs for equal work done. In relation to diesel traction its case rests largely on operating economies. Despite the turbine's considerably higher fuel consumption per h.p./hr than that of the diesel engine the cost of fuel and lubricant in relation to the ton-miles hauled is only a little higher for the turbine than for the diesel locomotive. Moreover, experience so far has shown that in the higher powers, gas turbine locomotives can be built with approximately half the weight and half the length of diesel locomotives of the same power.

British Equipment for Mecca

MR. Miles Beevor, deputy managing director of the Brush ABOE group of companies, said at a Press conference in London on Tuesday last that consignments of British equipment for the electrification of the Holy City of Mecca were now arriving in the Port of Jedda, Saudi Arabia. This equipment was part of a large contract placed with the Brush ABOE group by E. A. Juffali & Bros. of Mecca on behalf of the Saudi Electric Co., which had obtained a concession from the Saudi Arabian Government for the provision of a public supply of electricity in Mecca.

Power would be supplied for street and house lighting and industrial purposes such as wood working machines, motor garages, flour mills, and ice plants. Up till now there had been no general supply of electricity in the Holy City, only a few people having individual plants.

A power station was being sited outside the walls of Mecca, and equipment within the city would be erected under the supervision of Brush ABOE trained Moslem engineers, since that city was not open to non-Moslems. There would eventually be fifteen substations in Mecca itself. The work inside Mecca would be supervised by Mr. N. A. Malik, of Karachi, Pakistan, who recently visited England to familiarize himself with the electrical equipment.

Equipment for the electrification scheme includes four Mirrlees-Brush diesel generating sets. Two of these comprise standard HFS8 engines driving 700 kW alternators, the others consisting of KVS12 engines driving 1,170 kW alternators. Generation will be at 11 kV 50 c/s three-phase and the control gear for the system is based on the Brush VA standard unit. A nine-panel board is to be provided in the power station, which will feed three main substations; these will be linked by a ring main in which some 25 miles of cable, mostly underground, supplied by the British Insulated Callender's Construction Co., Ltd., will be used. The plant capacity will eventually be increased to 10,000 kW.

The three main substations comprise Brush outdoor type transformers of 300, 200 and 100 kVA stepping down to 415 V three-phase, four-wire, and controlled through Brush ring main switching units on the h.v. side and B.I. Callender's Cables tailless units on the l.v. side. Ring main transmission and distribution systems are being provided by B.I. Callender's Cables as sub-contractors to Brush to their standard designs. The consulting engineers were Preece, Cardew & Rider, of London.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

The Right Perspective

IN his article under the above heading (18th January), Mr. W. Szwander advocates a number of ways of limiting load and concludes by expressing the view that ripple control is the answer. It is quite clear that under present economic conditions an overall scheme of ripple control is out of the question. Capital expenditure, shortage of materials and lack of a suitable system which could be satisfactorily applied to all networks in this country, leave such a realization but a generating engineer's dream.

Money speaks louder than warnings, and it would seem much more practicable to enforce limitation of load, when required, by making the consumers pay at a higher rate during peak periods. The two-rate system is not new. An easy way of introducing such a system would be to add a meter and time-switch to every existing metered installation. Since meters and time-switches are standard products, mass produced, the capital outlay would be considerably less than that needed for new ripple control installations. If the high tariff was sufficiently high, consumers would soon see to it that they switched off during peak periods.

Sutton, Surrey. CECIL SCORES.

ALTHOUGH 90 per cent or more of the electricity consumed in our all-electric home is used off peak, up to now no equitable off-peak rate is available to recompense us for the extra capital outlay on our specially designed installation which has made this essential contribution to the improvement of the load factor.

Leicester. B. GILL.

Power Station Construction

I WAS interested in the article in your issue of 18th January, in which you described the construction of the precast reinforced concrete turbine room structure at Acton "B." According to the figures given, the weight of steel involved was 0·16 ton per sq yard of area covered.

I should like to draw your attention to the fact that at Skelton Grange power station, Leeds, the steel used amounted to 0·09 ton per sq yard. The Skelton Grange turbine room is also of reinforced concrete, but is of *in situ* construction, with beams for a 150 ton crane and a "Chisare" shell roof spanning 74ft. Special methods of scaffolding kept the basement floor clear of obstruction during the roof construction.

You will see, therefore, that when aiming at economy of steel, the precast construction you describe is not necessarily the best.

Berkhamsted. H. E. MANNING, M.I.C.E., M.I.Struct.E.
Director (Holst & Co., Ltd.).

Television Aerial Earthing

A CORRESPONDENT has suggested (18th January) that there is a measure of risk of television aerials being struck by lightning. If there was any significant danger to property, the insurance companies would not be slow in adding a shilling or two to the normal householder's comprehensive premium. Each of our aerials carries an insurance against damage by lightning and this is passed on to the ultimate user. During the past sixteen years, well over a million "Skyrods" and television aerials have been sold by us and erected, but there have only been five claims for damage by lightning brought to our notice, and in no case was damage done to the fabric of the house. In the same period many thousands of buildings without television aerials must have been struck and damaged.

When lightning conductors are fitted to a high building, the conductors are generally of very heavy copper strip about 1½ in wide and ⅛ in thick. Cost of labour and material would be many more times that of a television receiver and its aerial. Such buildings are not immune and if the lightning charge is heavy, the copper will melt, but generally the copper is heavy enough to carry the discharge. In the case of a television aerial, if the aerial is struck, the

feed (lead-in) generally disappears. It is instantaneously melted and the discharge follows the path of the metallic vapour. If the aerial system is not fitted with an outside spark-gap the receiver may be damaged, but that is all. While the presence of an outside gap might protect the receiver, we would not guarantee that it would under all circumstances.

The rising column of smoke, or even air, issuing from a chimney is more conductive than the normal air surrounding the roof. The influence of that smoke, or air, is greater than any aerial and if a static or lightning charge chooses to go to earth in the vicinity, it will follow down that conductive air column and probably shatter the chimney, and perhaps destroy the fireplace on the way. In any case, the damage would be much more serious than if a television aerial was struck.

Enfield, Middlesex. N. D. BRYCE,
Sales Development Manager,
(Belling & Lee, Ltd.).

Locomotive Efficiencies

IN his article in the 18th January issue of your journal, "W.C.J." gave a reasonable estimate of the amount of coal which could be saved per annum by the electrification of the railways. Apart from the 9,150,000 tons of coal which could be put to better use in these times of fuel shortage, a reduction in expenditure of some £30 million would result annually.

But that is not all. If the locomotives of this country consume 13 million tons of coal a year, they must use, at a very conservative estimate, at least 65 million tons of water. Since the locomotive is a non-condensing engine, this is all lost to the atmosphere. If the railways were electrified the amount of make-up water in power stations to supply the electrical demand would be about 6 million tons, or less than one-tenth of that required by railways to-day.

A further saving would accrue on the item of lubricating oil. All electrical engineers will appreciate the difference between the lavish requirements of a reciprocating engine and the almost negligible requirements of an electric motor. A locomotive requires, I believe, about a pint of oil per 10 miles run. A conservative estimate of the saving on oil and water works out at about £300,000 annually. Account must also be taken of the "outages" occurring with the steam locomotive, such as boiler washing, fire cleaning, cooling, watering, etc., not to mention the heavy maintenance expenditure on boiler and motion overhauls and repairs.

British Railways tell us of difficulties in recruiting staff, because of the attraction of more amenities in other, cleaner, jobs. The elimination of the laborious, hot and dirty job of operating a steam locomotive by substituting a much cleaner and easier electric drive might give an incentive to the recruiting of staff also.

The country generally would benefit by the reduction of atmospheric pollution by electrification, which benefit would be difficult to assess in terms of money.

The chief obstacle to a process of electrification would appear to be the difficulty of materials and, partly, financial, although the savings mentioned would tend to offset capital charges to some extent.

It may be, however, that the dire necessity of saving some nine million tons of coal annually may compel us ultimately to give some priority to this business of electrification. C. H. FIELDING,

Glasgow. B.Sc.Tech., A.M.I.Mech.E.

Private Electric Vehicles

MAY I make the following suggestions for the encouragement of battery electric vehicles for private use?

1. The production of three standard battery electric vehicles:—(*a*) Motor cycle; (*b*) two-seater car; (*c*) four-seater car.

2. The mounting of all batteries on rollers.

3. The provision of charging facilities and standard fully charged batteries at depots throughout the country, together with battery racks mounted on wheels and provided with roller tops so that a standard set of batteries could be slid off the vehicle on to the stand and another set substituted in no longer time than it would take to refill with a few gallons of petrol.

4. The yearly publication of a handbook, divided into two sections, and giving:—(*a*) Addresses of establishments throughout the country where charging facilities are available; and (*b*) addresses where a battery exchange service is available as well as charging facilities.

Walthamstow. PERCY G. C. WILDING.

The B.E.A.M.A. Dinner

Praise for the Electrical Industry

WELL over a thousand members and guests attended the first post-war annual dinner of the British Electrical and Allied Manufacturers' Association at the Grosvenor House Hotel, London, W.1, on 24th January. Sir George Nelson, the president, took the chair.

Mr. T. F. Lister, chairman of the B.E.A.M.A. Council, in proposing the toast of "Our Guests," said that a letter had been received from Mr. Duncan Sandys, the Minister of Supply, expressing his inability to be present, and congratulating the electrical industry on its achievements in 1951. The delivery of new generating plant to the British Electricity Authority, the letter said, enabled it to commission more capacity than ever before. Notwithstanding that heavy demand, the industry's foreign exchange earnings in 1951 amounted to £180 million; the industry had become the second largest exporting industry in the country.

Mr. Lister went on to say that the large growth in world trading conditions in recent years had resulted in the formation of many friendships overseas. Visits to and from other parts of the world, which had been accelerated and aided by modern air travel, had brought better understanding and appreciation of each other's troubles and a wish to find a way out of those difficulties. All the countries with whom they had contacts still looked to Britain as a place worth appreciating.

The Rt. Hon. Lord Radcliffe of Wermeth, P.C., G.B.E., Lord of Appeal in Ordinary, in replying to the toast, said that operating on a much greater scale and with far wider contacts, B.E.A.M.A. was to-day doing for essential, modern and progressive industry and science what the city companies had done for the country in the past. The Association was concentrating great professional knowledge and skill, the intimate knowledge of a craft which bound men together beyond the separating influences of different countries and different forms of organization, and was to-day doing on a vaster scale what the great men of the past did from the small centre of these islands. He noted with great interest and admiration B.E.A.M.A.'s recent venture of founding a Chair of Electrical Engineering at Cambridge University.

Professor E. N. da C. Andrade, F.R.S., Director of the Royal Institution, who

Mr. V. Watlington's table: Mr. W. J. Jones, Mr. E. G. Batt, Mr. C. E. Wallis, Mr. R. W. Foxlee, Sir John Dalton, Mr. Watlington, Sir Lynden Macassey and Mr. J. Davidson Pratt

pro[illegible]sed the toast of "The Electrical Indus[illegible]," said it was strange to think that the [illegible]lectrical industry was a pyramid built alm[illegible]st entirely within the lifetime of a man of [illegible] age. The complexity of the industry wa[illegible] xtraordinary and it comprehended a va[illegible]range of human activities, from physics at [illegible]e end to politics at the other. Between th[illegible]ources of inspiration at one end and of im[illegible]ediment at the other lay a vast field of [illegible]tivity.

[illegible]he research carried on within the ind[illegible]stry to-day was impressive and well jus[illegible]fied the astronomical sums spent on it. Th[illegible] Royal Society numbered among its feli[illegible]ws some of the great leaders of industrial research who not only produced matters of commercial and industrial importance but also made discoveries in fundamental matters which influenced the whole history of the science.

All that immense and varied activity demanded a far-seeing organization, nourished with knowledge and led with vision, with an intimate acquaintance with the needs and circumstances of the industry and an infinite faith in its future. The Association was such an organization. It was founded as long ago as 1911, he had found, which surprised him, because he had been led to believe by newspapers, politicians and orators that organization in industry was new, something born twin at a birth with austerity!

The flourishing state of B.E.A.M.A. was due largely to the individuals who had been and were in control. There was the great pioneer D. N. Dunlop who was largely responsible for B.E.A.M.A.'s foundation, and Sir George Nelson, whose personality and achievements he admired. He selected two other names as typical of B.E.A.M.A., those of Mr. Lister, the chairman, and Col. Leeson, the Director. It had delighted him to detect that with all their knowledge of electrical engineering in its widest sense they had the keenest interest in the personal well-being, happiness and opportunity for advancement of all those hundreds of thousands employed in the industry.

Sir George Nelson, in replying to the toast, said that the installed capacity on the

Left: **Lord Radcliffe responding for the guests.**
Right: **Professor Andrade proposing "The Electrical Industry"**

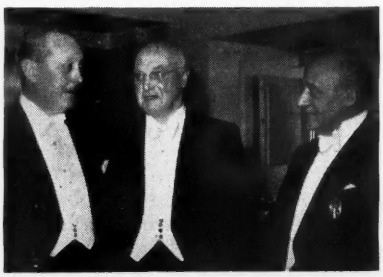
Col. B. H. Leeson's guests: Dr. S. Whitehead, Professor E. B. Moullin, Sir John Hacking, Col. Leeson, Sir Archibald Forbes, Mr. R. Gresham Cooke, Sir Hugh Warren, Mr. A. W. Berry, Mr. W. J. Drummond and Mr. A. L. Johnson

Mr. V. Watlington, Sir Harry Railing, Sir Edward Crowe and Mr. D. Maxwell Buist

generating side in this country had risen from under 1,000,000 kW 40 years ago to 15,000,000 kW by 1950, and he wished officially to congratulate the British Electricity Authority on last year bringing into commission over 1,100,000 kW of generating plant. He assured the B.E.A. that the industry was ready and willing, and continuously striving, to contribute to the advantages of nationalization to offset at the same time the well-known disadvantages of bureaucratic control.

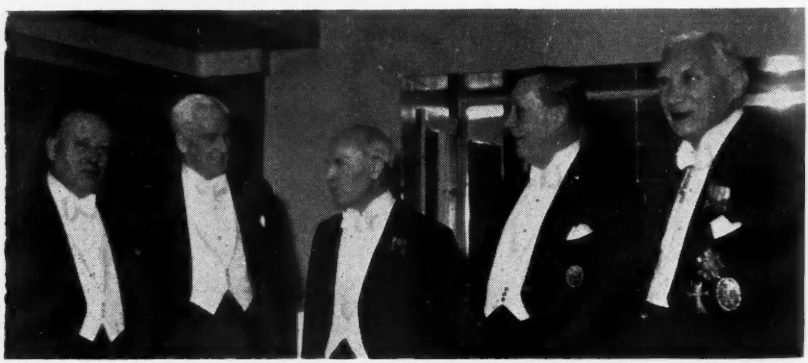
Twenty-five years ago the manufacturing industry employed 150,000 people; now there were 660,000. Twenty-five years ago its exports were £16 million; in 1951 they were £180 million, and the industry was the second greatest exporting industry of the country. That was a measure of the progress which had been made.

He had been told that if all the countries of the world were to develop to the stage at which they would absorb consumable materials at the rate at which they were being consumed in America, the total supply of many essential minerals would be exhausted in one generation. Our research, development and production must be planned to replace those materials by the time they were exhausted. New sources of materials must be developed, such as the production of aluminium from clay, and there were immense sources from which titanium, with higher physical properties than steel, could be produced. Nuclear



Left : **Sir George Nelson (president), Mr. T. F. Lister (chairman) and Sir Harry Railing (vice-president)**

Below : **Mr. E. C. Holroyde, Lord Citrine, Professor E. N. da C. Andrade, Sir George Nelson and Sir Edward Crowe**



ion was coming to the stage when it uld generate steam to drive turbines; d that would be the next stage when coal d oil had gone.

He hoped that many in the room would inspired and encouraged to make some ntribution to the future supply of terials in the world. He hoped that in the ture B.E.A.M.A. would spend millions of unds on research on the development of wer from nuclear fission and other pro-sses, and he could say that it would be ady to do it with the help of the overnment.

He urged Government attention to the roblem of scientists, designers, engineers and development people in industry who, as pointed out by Lord Beveridge and Mr. Richard Stokes, Minister of Works in the last Government, had not enough to live on when taxation had been deducted from their earnings.

Sir Harry Railing, vice-president of the Association, in proposing the toast of " Our President," said that Sir George Nelson had preached to the outside world in an extraordinarily effective manner the value of B.E.A.M.A. and had shown the members what their responsibilities were. The Association had always had the one aim of creating an efficient industry and, by so doing, serving the community, the State and the world. It was one of the first organizations to apply the dynamics of co-operation.

In replying to the toast, Sir George Nelson said that he would do his best not only for B.E.A.M.A. but also for the industry, for this country and for the countries of the Commonwealth.

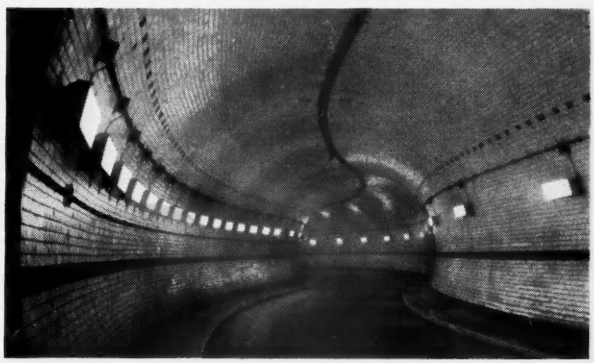
Lighting of Blackwall Tunnel

AFTER experiments with different types of lighting the London County Council decided in 1949 to undertake the complete relighting of the Blackwall Tunnel, London, at an estimated cost of £30,000. The first section (the Poplar end) is now in operation.

Tunnel lighting presents certain difficulties not present in ordinary street lighting. Drivers may plunge suddenly from brilliant sunlight to comparative gloom and their eyes require a few seconds to adapt themselves. It is not practicable or necessary to illuminate the whole tunnel to daylight intensity, but the new lighting has been arranged so that it is more intense at the entrance and tapers off gradually.

A further difficulty in a narrow tunnel which is used continuously is that of maintenance. The existing lights are in the crown of the tunnel and require the use of a tower wagon. The new lights are therefore fixed at the sides of the tunnel at a height which is a compromise between accessibility, effective lighting and clearance between the lights and passing vehicles. In this lowered position it is extremely important that no glare falls in the eyes of the drivers.

To meet these conditions a special lighting fitting was designed by the L.C.C. Chief Engineer's Department and 120 of these, manufactured by Courtney Pope (Electrical), Ltd., are now installed at the Poplar end of the tunnel. Each contains an 80 W fluorescent tube, together with a set of louvres and its control apparatus. They have to be waterproof because the tunnel is cleaned with a hose. The mounting height is 8ft 6in above the pavement and the normal spacing is 30ft: at the entrance they are considerably closer. There is no glare



View of Blackwall Tunnel from northern entrance showing lighting on bends

and the effect is rather that of a series of illuminated windows than of street lighting fittings, serving as a guide line somewhat after the fashion of white lines painted on road surfaces.

Each lamp is connected to the mains by a fused plug. It is believed to be the first time that this system has been used for an extensive lighting installation such as this and its use has resulted in considerable simplification and economy in wiring.

E.C.A. Branch Dinner

SPEAKING at the sixth combined annual dinner of the Maidstone and East Kent Branches of the Electrical Contractors' Association at Tunbridge Wells on 24th January, Mr. John Rodgers, Conservative M.P. for Sevenoaks, said that if an Electricity Board entered into trading it should only do so on exactly the same terms as private enterprise.

In reply, Mr. Stanley N. Watkins, president of the E.C.A. and Allied Associations, drew attention to the serious state of affairs in this country. He told members that he wondered how much waste could be avoided. High prices were having serious repercussions in their trade. The only answer was increased production, and high wages could be paid only if the output was there. While electrical engineers were prepared to do their best for their country, the crushing weight of taxation provided very little incentive.

The electrical industry, he said, had perhaps never been so prosperous before and electrical contractors were pioneers in helping to build it up. Should these pioneers now be crushed out by a nationalized body? Private enterprise had built the electrical industry and the country and he suggested that private enterprise could once again put the country on its feet. If the B.E.A. would meet them on equal terms and if the nationalized bodies would make only a fair return for capital invested, the E.C.A. would have no complaints.

In his toast to the civic authorities of Kent and East Sussex, Mr. A. Apps, chairman of the East Kent branch of the E.C.A., said that members in Canterbury had worked almost as salesmen and canvassers for their city electrical engineers. Ald. B. J. Watson, Mayor of Maidstone, and a member of the South Eastern Electricity Consultative Council, spoke of the local undertakings that had existed before nationalization. He said that they used to make some profit in those days but they ploughed it back into the industry.

Ship Research

IN the twenty-fourth Thomas Lowe Gray Lecture at the Institution of Mechanical Engineers Dr. S. Livingston Smith (British Shipbuilding Research Association) surveyed research which is being applied to shipbuilding and marine engineering. The object was to convey an idea of the scope and volume of investigation work of this kind that is now going on.

A large part of the lecture summarized structural investigations while the middle portion concerned hydrodynamics, concluding with references to ship performance, machinery, gas turbines, boilers, etc. A bibliography of 39 references to relevant publications on the subject is included.

Members and guests at the annual dinner of the Maidstone and East Kent Branches of the E.C.A.

Commerce and Industry

Large Installation Contract

High-voltage Cable for Canada

A FACTORY is being built by Scottish Industrial Estates, Ltd., to the order of the Ministry of Supply to produce the Rolls-Royce "Avon" jet engine. The factory is within the boundaries of the new town at East Kilbride, near Glasgow, and consists of four main production buildings, offices, boiler house, canteen and ancillary buildings.

The complete electrical contract has been placed with James Kilpatrick & Son, Ltd., the Paisley electrical engineers, and it represents the largest single order placed for electrical installation work in Scotland, the value being about £300,000. The company hopes to commence the work in two months' time and complete it by the end of the year.

The general arrangements for electrical distribution are as follows: From the South West Scotland Electricity Board's supply two 11 kV ring main feeders will be taken to two central h.v. switchboards supplying transformers with a total capacity of 6,000 kVA. From the l.v. switchboards at these positions feeders will radiate to approximately 100 control boards for power and lighting. The major portion of the power load will be supplied from overhead bus-bars. Lighting in the production areas will be of high intensity employing cold cathode four-tube lighting fittings. In addition there will be complete systems of internal telephones, public address and signalling equipment, clocks, time recorders, etc. External and road lighting of the factory area will be remotely controlled from the main gatehouse. The consulting engineers are Messrs. Donald Smith, Seymour & Rooley, Glasgow.

Order for 301 kV Cable

Pirelli-General Cable Works, Ltd., has received an order to manufacture and install an insulated cable for a higher voltage than that at which any other industrial cable in the world is at present operating. This will be made at the company's Eastleigh Works, Hampshire. This order has been placed in the face of keen competition from cable makers all over the world.

The order is for 0·4 sq in single conductor oil-filled cable and sealing ends to form a 750 yd termination for an overhead line in Canada, operating at 301 kV, three-phase, with centre point earthed. An order for a similar three-phase termination has been placed with a Canadian cable maker, and this cable will also be of the oil-filled type. The cable will be of graded dielectric construction with the lead sheath metal-tape reinforced and served overall with anti-corrosive finish. The carrying capacity of each cable is 530 A and the three-phase circuit will carry 275 MVA. The cable and all accessories have been designed by Pirelli-General in conjunction with Mr. Emanueli of Pirelli, Milan.

This cable will be employed in connection with a new smelting plant to be built for the Aluminum Company of Canada, Ltd., on the site of a deserted Indian village, Kitimat, some 400 miles from Vancouver, British Columbia.

Advertisement Lighting Restrictions

The Electrical Sign Manufacturers' Association has asked the Minister of Fuel and Power to reduce the restricted period during which electricity from the mains may not be used for advertising purposes to 7 a.m.—1 p.m. instead of 7 a.m.—7 p.m. Mr. Bernard Moss, secretary of E.S.M.A., said that the Association had pointed out that the position had considerably improved since last October when the present restrictions were fixed.

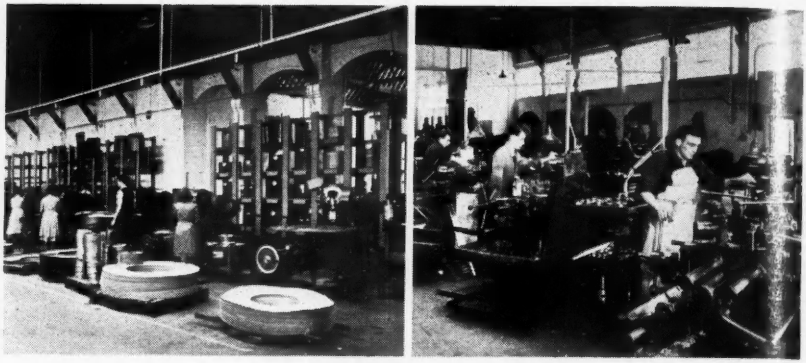
Free Fuse Wire

Doncaster electrical contractors have asked the local M.P., Mr. A. Barber, to protest to the Ministry of Fuel and Power against the introduction of free fuse wire for its consumers by the Yorkshire Electricity Board. The contractors complain that this is unfair competition; not only because fuse wire is sold by them to the public but because the cards supplied by the Board invite the consumer to get into touch with the Board "if anything goes wrong."

For the Electricity Board it has been stated that the cards ensure, by instructions, that the correct gauge of wire is used and that it is useful to the consumers to know how to get into touch with the Board when the necessity arises.

Laurence, Scott Developments

By taking over some existing buildings for operations not requiring heavy crane lifts, Laurence, Scott & Electromotors, Ltd., has been able to increase considerably the effective capacity of its three main works. At Norwich the light machine shop, control gear case-making department, notching and blanking presses and associated stores have been transferred, freeing space under cranes for an exten-



The notching and blanking press shop (left) and the turret lathe shop (right) of Laurence, Scott & Electromotors, Ltd.

sion of the heavy winding shop, for example, by 75 per cent, and permitting the reorganization on more convenient lines of other departments. Some of the transferred sections have also been enlarged; in one instance the floor area has been quadrupled.

A new continuous process impregnating plant put into operation recently for small-medium size induction motors threw into greater prominence a potential bottleneck in the winding department. This has been averted by the establishment of a "satellite" winding shop in an existing modern building, some distance away, which is fed from the main shop (by means of a 30-ton diesel trailer unit) with stators and material. No regular supervision above foreman level is necessary and the "satellite" winding shop needs no separate stores and no extra "paper work."

Women's Wage Increase

Under an award made by the Industrial Disputes Tribunal, women of eighteen years of age and over employed in the engineering industry are to receive an increase in wages of 10s 1d a week. Younger women will be given a proportionate increase. The new scale will date from the first pay week after 23rd November last, the date from which the male workers' wages were raised by 11s a week.

F.B.I. and the Budget

In a memorandum to the Chancellor of the Exchequer on the 1952 Budget, the Federation of British Industries expresses the hope that the Government, faced with the task of deciding how the cuts in expenditure are to be applied to meet the demand of the defence programme, will not allow the pressing exigencies of the immediate situation to mask industry's long-term needs. The pressure to increase the export of capital goods is obviously considerable, but the short-term advantage of this course will be dearly bought at the cost of jeopardizing the efficiency of British industry.

Cookers for the Blind

A simple mechanism invented by Mr. G. W. D. Currey, a G.E.C. service engineer, has enabled a standard electric cooker to be successfully used by a blind person. The device consists of two units. One indicates, by means of a trip mechanism, various temperature settings on the "Simmerswitch" and thermostat controls; the other is an electrical relay in series with the thermostat which, when energized, pushes out an indicator button through the switch panel on the cooker front and at the same time rings a low tone bell to indicate that the cooker is switched "on."

When the temperature as set on the thermostat is reached, a high tone bell rings and the button recedes into the cooker. The blind person has then merely to set her braille process timer before placing her cake, or whatever else she may be cooking, in the oven, and can carry

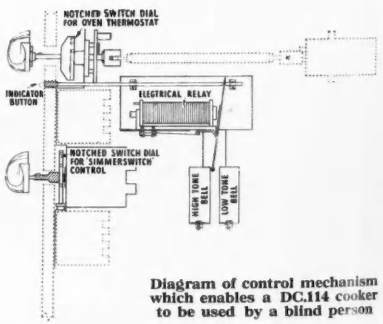


Diagram of control mechanism which enables a DC.114 cooker to be used by a blind person

on w[illegible] her duties in another part of the kitchen or h[illegible]se without continually leaving her work to t[illegible]h the button on the front of the cooker. T[illegible] General Electric Co., Ltd., has decided to s[illegible]ply this control unit without charge for use[illegible] any new cookers supplied to the blind. It w[illegible]s a happy coincidence that this invention was [illegible]ade available for the first time during the com[illegible]moration of the Louis Braille centenary.

Meter Readers' Strike

At a meeting last week at the Ministry of Labour between Sir Robert Gould, the Industrial Commissioner, and the parties concerned in the strike of London electricity meter readers, it was agreed that the men should return to work under the existing system of inspection while the situation was discussed. It was agreed that the London Electricity Board was entitled to employ supervisors. The trade unions undertook to study data to be supplied by the Board showing that there was a superfluity of meter readers in the London area. It was provided that if it became necessary to discharge redundant men the "last in first out" principle would be adopted and endeavours would be made to ensure that there would be no undue hardship. If possible the men would be found alternative positions in the industry.

Cardiff Business Club

More than 400 members of the Cardiff Business Club were present at the Park Hotel, Cardiff, on 21st January for an address given by Dame Caroline Haslett, D.B.E., J.P., Companion I.E.E. The chair was taken by Mr. G. H. Bowden, M.I.E.E., engineer and manager for Johnson & Phillips, Ltd., in the South Wales area. In her address, Dame Caroline said that her career was one of the results of the great awakening of women everywhere, and went on to say that the younger women, in particular, were calling for the removal of all barriers that prevented them from taking their place in the various professions and on the executive committees of industry. A vote of thanks to Dame Caroline was proposed by Prof. Gilbert Strachan, M.D., F.R.C.S., and was seconded by Mr. F. C. Bagnal, C.B.E. (managing director, British Nylon Spinners, Ltd). Many leading citizens of South Wales and several well-known electrical personalities attended. Before the meeting, the chairman had entertained the Lady Mayoress (Mrs. Robert Bevan), the president of the Business Club (Sir Robert Webber, J.P., D.L.) and others to a private dinner party. Among prominent people associated with the electrical industry at the dinner were Mr. L. Howles, C.B.E., M.I.E.E. (chairman of the South Wales Electricity Board), Mr. J. Bird, M.B.E., A.M.I.E.E. (chief engineer of the South Wales Electricity Board), Mr. E. Hywel Jones, M.I.Mech.E., A.M.I.E.E. (chief generation engineer, B.E.A., South Wales Division) and Mr. W. F. Cartwright (director and general manager, Steel Division, Steel Co. of Wales, Ltd.).

Fine Wire Supplies

British Driver-Harris Co., Ltd., of Manchester, announces that its fine wire section has been extended and re-equipped for the production of standard nickel chrome, copper nickel and pure nickel wire, in sizes down to 50 s.w.g.

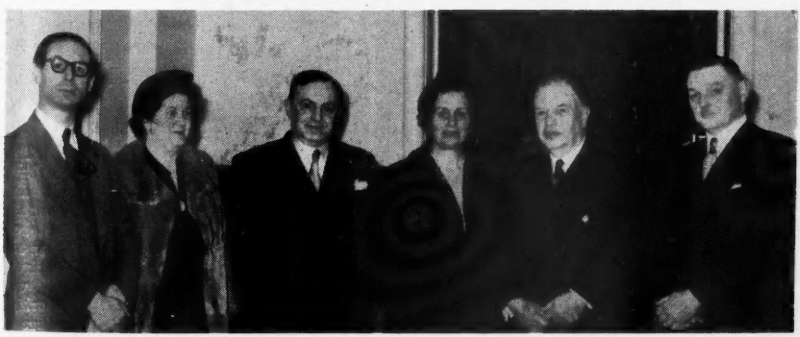
Control of Labour

Proposals by the Minister of Labour (Sir Walter Monckton) for dealing with the shortage of labour in essential industries were approved at a meeting of the National Joint Advisory Council last week. The principal item is the introduction of an Order which will stipulate that applications by employers and people seeking work shall be made through Employment Exchanges. This will help to direct labour into the most desirable channels.

It was agreed by the Council that it should

AT THE CARDIFF BUSINESS CLUB'S DINNER

Left to right: **Mr. E. Hywel Jones (chief generation engineer, B.E.A., South Wales Division); Mrs. G. H. Bowden; Mr. G. H. Bowden (Johnson & Phillips, Ltd.); Dame Caroline Haslett; Mr. L. Howles (chairman, South Wales Electricity Board); Mr. W. S. Gearing (Johnson & Phillips, Ltd.)**



take steps to induce employers to improve their training and apprenticeship schemes in order to expedite qualification for industry.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £148 0s 0d
COPPER, H.C. Electro	ton £227 0s 0d
Fire Refined 99·7 per cent ..	ton £226 0s 0d
Fire Refined 99·2 per cent ..	ton £225 10s 0d
COPPER Tubes	lb 2s 2d
Sheet	ton £280 0s 0d
H.C. wire and strip	ton £254 0s 0d
LEAD, English	ton £176 10s 0d
Foreign	ton £175 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £1,002 10s 0d
ZINC, G.O.B. Foreign	ton £190 0s 0d
Electrolytic	ton £194 0s 0d
BRASS Tubes	lb 2s 1d
Sheet	lb 2s 4¼d
Wire	lb 2s 7¾d
PHOSPHOR BRONZE	
Wire	lb 3s 7¾d
RUBBER, No. 1 R.S.S. spot ..	lb 40½d–41d

Patent Office Library

It has been decided to continue the extended hours of opening of the Patent Office Library, 25, Southampton Buildings, Chancery Lane, W.C.2. The hours are 10 a.m. to 9 p.m. Monday to Friday and 10 a.m. to 5 p.m. Saturday.

English Electric Display

In the accompanying picture we show the latest window display arranged by the English Electric Co., Ltd., at Queen's House, Kingsway, London, W.C.2. It has been designed to tie-up with the company's current advertising theme "Bringing you better living," and incorporates a platewarmer and food mixer.

A new English Electric display at Queen's House, Kingsway, W.C.2

Cable Drums

The Rubber and Thermoplastic Cable Manufacturers' Association announces that, to meet increased costs of materials and labour in the manufacture of cable drums, its members are increasing their charges in respect of all drums supplied as from to-day (Friday). The conditions under which drums are supplied have been revised and a schedule setting out the new terms and prices has been issued. The new conditions have also been adopted by the Mains Cable Manufacturers' Association.

Catalogues and Lists

The Morgan Crucible Co., Ltd., Battersea Church Road, London, S.W.11.—Catalogue (SD.41) and technical brochure (SD.40) on Morganite "Reservoil" oil retaining bearings.

Metway Electrical Industries, Ltd., King Street, Brighton, 1.—Illustrated price list No. DG/2 on wiring accessories.

The Vacuum Oil Co., Ltd., Caxton House (East), Tothill Street, Westminster, London, S.W.1.—Illustrated technical booklet "Wire Rope Lubrication" (Vacuum technical series No. 3).

Chloride Batteries, Ltd., Exide Works, Clifton Junction, Near Manchester.—First complete edition since 1939 of the Chloride Stationary Battery Catalogue.

E. C. Hopkins, Ltd., Grosvenor Street West, Birmingham, 16.—1952 illustrated engineering catalogue of electric tools and production equipment.

Gas-turbine Tanker

The first merchant ship to have a gas turbo-alternator included in her a.c. propulsion plant arrived, after a round trip across the Atlantic and back, last week at Southampton. She is the oil tanker *Auris*, built for the Anglo-Saxon Petroleum Co. as an experimental vessel and equipped with four diesel-alternator sets (*Electrical Review*, 23rd February, 1951), one of which was subsequently replaced by a gas turbo-alternator of B.T.H. design and make for comparative trials. This set is reported to have run at full power and without trouble throughout the October-January Atlantic voyage. Comparatively heavy fuel oil was burned in the turbine during the last stage of the trip.

Industry and the House

Steps to Deal with Economic Crisis

By T. F. COOK, M.P.

By the time this article appears in print Parliament will have resumed after an overlong recess. A very lively and busy Parliamentary period lies ahead of the Government. In view of all that has been happening in Government circles during the recess this is not in the least surprising.

The main battle will be on Mr. Churchill's statement to the House as to what he accepted in Washington with regard to Anglo-American policy on Chinese recognition, etc. But the first major discussion will be on Mr. Butler's statement setting out his proposals for dealing with the present economic situation. As was forecast in these columns recently, the clamps are tightening on industry slowly but very definitely.

Employment and Apprenticeships

Sir Walter Monckton, the Minister of Labour, is said to have secured the unanimous backing of his National Joint Advisory Council which consists of the "top brass" of trade unions, employers and the nationalized industries for a large-scale labour switch, job control and a major overhaul of industrial training schemes. These measures are calculated to obtain a smooth and efficient change-over in employment for over 500,000 from the production of goods for home consumption to defence, dollar-earning and dollar-saving production.

The N.J.A.C. has agreed to support the Minister's proposals for a new Order that will make the Employment Exchanges the sole machinery through which workers, if they become unemployed, will apply for jobs. Employers will also have to apply to the exchanges for any of their labour requirements.

The Council also agreed to ask selected industries to review their training and apprenticeship methods in order to extend the existing age limits of entry and shorten the training period. Those selected industries will be asked to review their apprenticeship arrangements and will be given five points to consider.

(1) If the scope of their training arrangements could be widened; (2) if the period of training could be shortened; (3) if the minimum age of entry into apprenticeship could be lowered; (4) if the present upper age limits could be removed or modified, in order to allow suitable older workers to be accepted as craft apprentices; (5) if with intensive methods of training, workers could be trained for a wider range of jobs.

Industries will also be asked to examine closely their methods of selection and training of supervisors and foremen; this is considered an important factor in increasing productive efficiency. Sir Walter Monckton is expected to make an announcement to Parliament at an early date, setting out his proposals for "steering" workers into essential industries.

The new Order will give the Ministry of Labour virtual control over labour because it further contemplates setting up a labour supply inspectorate to ensure that industry is making the most efficient use of present manpower. These inspectors will be drawn as far as possible from existing Ministry of Labour staff.

The Minister does not contemplate direction of labour or even of penal sanctions against the workers, but it is understood that some form of sanctions will be operated against employers who attempt to get round the need to fill their vacancies from the Employment Exchanges.

Reaction of Craft Unions

This labour control arrangement will be operated along parallel lines with the raw material allocation schemes. While the Minister has no doubt received the support of the N.J.A.C. the effect of the proposals are so far-reaching that it will be interesting to see the reactions of the craft unions to them. They cut right across many of the traditional prejudices of some of the older

of these unions and it would be sheer naivété to expect some of them to accept large-scale dilution and a break-down of the traditional lines of demarcation added to a revolutionary change in their agreed apprenticeship schemes.

Production and Raw Materials

The N.J.A.C. also issued a statement focusing attention on the balance of payments crisis and on the declining rate of increase in production, pointing out that the cause of this was partly insufficient material and partly contracting markets at home and overseas.

Shortage of materials has also been responsible for an increase in short-time working. It is expected that Mr. Butler's statement and the subsequent debate will bring out quite clearly what the Government intends to do and dispel the clouds of confusion which have existed for the last two months.

The importance of purchase tax in the national revenue is brought out by the figures in the 1950–51 report of the Commissioners of Customs and Excise published on Friday last week. In that year it produced the record total of £302,500,000 and 70,660 registered traders were acting as unpaid tax-collectors. The electrical industry contributed roughly £25,000,000 of the total.

The recent statement of the chairman of Lloyds Bank, Lord Balfour of Burleigh, is worthy of study. He makes a very strong plea for a return to the era of greater financial discipline. It is interesting to notice that four directors of Lloyds are now members of the Government, Lord de Lisle and Dudley, Secretary of State for Air, Mr. D. Heathcoat-Amory, Minister of Pensions, Lord Ismay, Secretary of State for Commonwealth Relations, and Sir Peter Bennett, Parliamentary Secretary to the Minister of Labour.

Peak Demands in America

Estimated Margins of Plant Capacity

THE greatest demands on public electricity supply systems in the U.S.A. usually occur in the middle of December and start to decline in January. Estimates prepared by the Edison Electric Institute of the position during the week beginning 13th December last, summarized in the *Electrical World*, show a margin of about 7·8 per cent of the demand to be available as dependable reserve, which is considered as only just enough to meet requirements. This figure is based upon medium hydro conditions; had these been adverse the margin would have been only 5·4 per cent.

A plant capability of 74,925 MW for the whole country has to cope with a peak of 69,498 MW. As between the eight Federal Power Commission regions, the margin varies from +21·0 to −4·3 per cent, being 9·3 and 7·1 in two regions with the biggest output and slightly negative in two others. By 1954 the reserve in the first two instances is expected to have risen to 15·3 and 14·2 per cent, while in the other two the adverse balance would have become positive at 2·4 and 11·9 per cent. For the United States as a whole the effective margin in 1954 is forecast at 15·5 per cent with medium water-power conditions and 13·2 per cent if these are adverse.

The gravest concern of the industry now is delay by manufacturers in shipping all the equipment needed for new power stations, as the non-availability of even the smallest item of auxiliary apparatus can prevent the commissioning of plant. At 1st October, 320 MW of plant was thus affected, which is regarded as a trivial amount in relation to 4,074 MW of generators of 4 MW and over. The total deliveries which were scheduled for 1951 amounted to 6,112 MW, but not all could be installed.

The delivery of 10,421 MW of generators in the same category has been arranged for the current year and 11,065 MW for 1953, but manufacturers cannot, it is stated, meet these requirements for generators or other plant unless the supply of materials increases rapidly.

Large-Scale Catering

Increasing Dependence on Electrical Appliances

THAT the special attributes of electrical appliances are becoming more and more appreciated in the catering industry is very evident at the Hotel, Restaurant and Catering Exhibition at Olympia, London, which closes to-day.

A collection of apparatus which will allow a limited number of meals to be served at special times and improve hygiene appears in a model working kitchen of a medium-sized hotel catering for a dining capacity of 50–75 meals, arranged by the Electrical Development Association. It includes a Crypto steamer; Hobart potato peeler and slicer; G.E.C. water heater, griller, pastry oven and extractor fan; "Prestcold" refrigerator; "Creda" two-unit range; Jackson hot-cupboard; Peerless food mixer; Santon water boiler; "Cona" coffee maker; "Dualite" toaster; and fluorescent lighting fittings (Crompton Parkinson, B.T.H., and G.E.C.) specially designed for kitchen use.

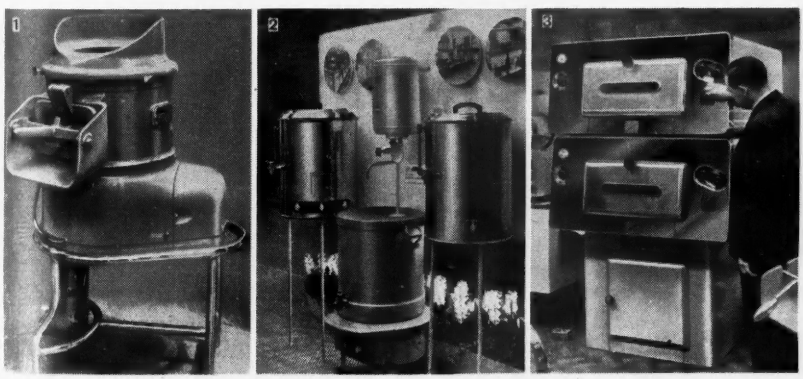
Displayed outside the kitchen area itself are a hand and face dryer (Quiz Electrics), a clothes drying cabinet (Belling) and a deep frying unit (John Kelly). Fourteen miniature displays depict the more general applications of electricity in the lounge, bedroom, etc.

The General Electric Company's comprehensive display includes a double oven range, a single deck pastry oven, a stockpot and soup boiler, water heaters, luminous call system, fans, various labour saving appliances and lamps, two new electric urns and a number of decorative lighting fittings. The urns, which are of 6 and 10 gall capacities respectively, have copper bodies and push-button reset safety cutouts.

The increasing popularity of the unit type of cooking ranges is evidenced by the fact that since the Simplex Electric Co., Ltd., showed the prototype of its new range two years ago nearly a thousand have been installed. The unit principle has now been extended to include roasting oven and boiling tables and prototypes of these form the central feature of the company's stand. A new chef's range also makes its appearance in prototype form, together with the latest automatic steaming oven which operates at a slight pressure, a restaurant range, hot-cupboards, grillers and a fish fryer.

A great deal of attention has been aroused

(1) Crypto 14 lb vegetable peeler. (2) New 10 gall and 6 gall G.E.C. urns with 1½ gall water heater and 16 gall stockpot and soup boiler. (3) Peerless baking oven



Benham " Hyco " roll cutting machine

by the daily demonstration of the Jackson Electric Stove Company's pastry oven. A variety of pastries, cakes and scones are produced to illustrate the capacity and baking ability at low fuel cost, it being pointed out that one user bakes 3,500–4,000 cakes at a consumption of 90 kWh in a six-hour day. With the pastry oven are a single-oven chef's range with multiple plate hob, a chromium plated vegetable boiler with steamer, an electric grill on stand, a steamer, oven and a selection of hot-cupboards ranging from the small service type to the large capacity unit with bain marie and food containers. A recent innovation is the fitting of all hot-cupboards with lift-out doors.

A new double oven with two 21in by 18in by 23in ovens and four 24in by 12in hotplates is shown for the first time by Carron Company. The ovens are loaded at 6 kW each and the hotplates at 5 kW each. A square boiler occupying less room than a round model of similar capacity is another new Carron product. Accompanying a particularly substantially constructed unit range and a boiling pan on the Falkirk Iron Co.'s stand is a redesigned pastry oven with the switches mounted on the top and with thermometers in each oven. An improved design of control panel is now incorporated in Benham & Sons' heavy duty range.

Apart from their extensive display of mincers, slicers, potato peelers, chippers, pie making machines, dishwashers, etc., Peerless & Ericsson show a new baker's oven (single or double deck) which has a booster device for rapidly heating up the oven or for browning purposes. Each oven (6 kW loading) is fitted with an automatic timer giving audible and visible warnings, thermostatic control with push-button reset thermal overload protection, a steam take-off damper and an oven light. A proving compartment with a 1 kW loading can be incorporated in the base. A new thermostatically controlled electric deep fat fryer is shown for the first time by Frank V. Magrini, Ltd.

Several types of hot-cupboards, self-service counters, etc., are exhibited by Rowe Bros. & Co., Ltd., the Crittall Kitchen Equipment Co. (1950), Ltd., G. F. E. Bartlett & Son, Ltd., John Mollett, Ltd., and Gardiner & Gulland, Ltd. In the last-mentioned company's display are a development of the " Alacarte " hot closet, with slide-over covers, chip scuttle, pie drawers and four individual soup and gravy containers; the " Polarslab " counter top refrigerated display and cold cupboard with overhead refrigerated shelf for the display and serving of salads, etc.; and an infra-red service counter (fitted with eighteen " Osram " 230 W infra-red lamps) which with its combination of light and heat is claimed to produce a favourable psychological effect on the prospective customer. Other specially interesting items for counter use are a small thermostatically controlled fryer (Crypto) and the " Turmix " infra-grill (A. E. Warner (London), Ltd.).

New hot-cupboards are introduced by James Stott & Co. (Engineers), Ltd., in two types, the " Empire " with vitreous enamel finish and the " Colonial " in stove enamel. The lift-out doors are extremely light, being of laminated plastic sheet steel backed. A new type of element gives more uniform heating for smaller electricity consumption. All controls are contained inside the angle formed by the flush fitting panels. Other Stott products on view are the " Derby " water boiler with improved lagging, a boiling pan with especially easily removed controls, an automatic steamer in five sizes, café sets, an industrial tea making unit and the latest Continental coffee maker. Further examples of water boilers and café sets are to be seen on the stands of Hodgkinson & Co., W. M. Still & Sons, Ltd., Minimax, Ltd., Jackson Boilers, Ltd., and the " Cona " Coffee Machine Co.

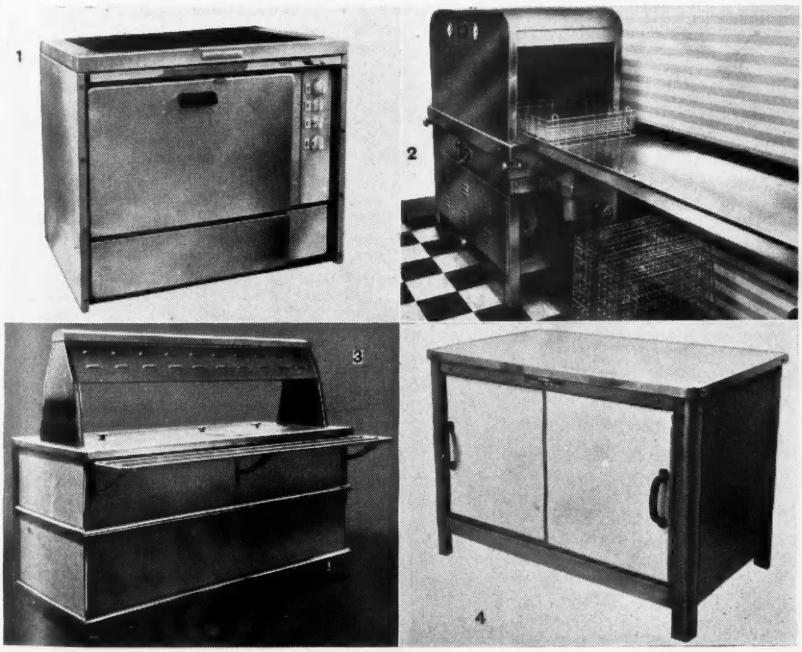
Among food preparation equipment we

notice at least four new vegetable peelers. Crypt Ltd., and Swift & Swallow, Ltd., introce new 14 lb models, while the Avan e Engineering Co., Ltd., now has both 5 lb and 25–30 lb models available in oy r grey vitreous or stove enamel. A pota peeler is the latest attachment added to th " Chef " domestic type food preparation it made by Kenwood Electrics, Ltd., who ave just brought out a larger example of t apparatus, the " Chef Major " for larg scale catering service. Of compact cabi t design which harmonizes with mod n styles, it has three separate power outl s providing for mixing, whisking, beat g, mincing, " liquidizing," etc. The liqui izer has a separate high-speed motor and can be used simultaneously with the mix g or mincing devices. Two bowls of 10 and 20 pt capacity are provided. Another domestic type mixer, the " Magimix " is demonstrated by E. J. Bowman (London), Ltd., while among the many makers of industrial type mixers Reids & Barrons Mixers, Ltd., show their " Manna Rex " machine.

A new high-speed pastry roller with an illuminated thickness indicator is among the Hobart kitchen equipment. The " Wickstead " bread buttering and slicing machine is accompanied by the latest electric coffee mill on the stand of Catering Machinery, Ltd., while the new " Hyco " roll cutting machine makes its first appearance among Benham & Sons' display. Several new items are also to be seen among general displays of food preparation equipment by Medcalfe & Co. (1950), Ltd., Fairfax Engineering, Ltd., and Metcalfe Equipment, Ltd. Among many exhibitors of electrically heated food trolleys are the Avamore Engineering Co., Ltd., Frank V. Magrini, Ltd., and Euk Catering Machinery, Ltd.

The refrigeration equipment on view represents both storage and display requirements. A new open refrigerated counter is shown by Hussmann British Refrigeration,

(1) Prototype of Simplex chef's range. (2) Hobart fully automatic dishwasher. (3) Gardiner & Gulland infra red service counter. (4) Stott " Empire " hot-cupboard



Ltd., with a small display unit specially designed for meat and poultry, and an open self service cabinet for frozen foods. The new " Carlton " commercial refrigerator, a new domestic model (" D.7.S "), a bottle cooler and a refrigerated drink dispenser are among the display of Marco Refrigerators, Ltd. " Prestcold " models include the new 15·4 cu ft service cabinet, a 350 lb capacity frozen food cabinet and ice cream conservator, 7 cu ft and 3·1 cu ft domestic units, a wet fish cabinet with a new grey finish, and a milk bar incorporating refrigerated milk storage, ice cream conservator and refrigerated fruit squash dispenser.

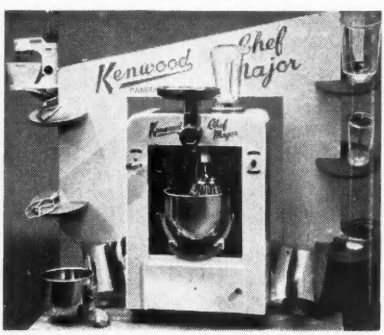
What is claimed to be the first all metal deep freeze cabinet or farm freezer on the market has been developed by Nash-Kelvinator, Ltd. Other interesting units are demonstrated by L. Sterne & Co., Ltd., and Frigidaire, who include a beer cellar in their display.

Dishwashers are exhibited in great profusion. A new fully automatic Hobart machine, which can be fitted with electric heating if desired, has a capacity of 7,700 dinner plates an hour. A range of three new machines exhibited by Dawson Bros., Ltd., can cater for from 100 to 1,000 people per hour. W. M. Still & Sons, Ltd., make a special feature of their recently developed " No. 6 " machine. A combined wash-up and sterilizing sink unit is shown by James Stott & Co. (Engineers), Ltd., and this is the first time the new " Kent " machine (Max Arc & Electrics, Ltd.) has been shown at this exhibition.

With improved crockery washing machines shown by the Staines Kitchen Equipment Co., Ltd., are a new cup washing and sterilizing machine, a special machine for washing teapots and both glass washing and polishing machines. Immersion elements are now used instead of the clamp-on type in the dishwasher which with toasters, toaster grillers, hot closets, bains marie and fish fryers, is exhibited by Catering Machinery, Ltd.

On the Staines stand is also introduced the new Electrolux Model 33 commercial and light industrial cleaner, features of which are its remarkable quietness of operation, air filtering arrangements and ease of emptying. The Hoover heavy duty machine is also on view, together with the Hoover " Glassmaster," which washes 1,500 unsorted glasses an hour, and examples of the company's fractional h.p. motors suitable for powering many kinds of kitchen equipment. A complete range of floor scrubbing, drying, vacuum cleaning and polishing machines is demonstrated by R. G. Dixon & Co., Ltd.

Kenwood " Chef Major " food preparation unit



R.C.E.E.A. Luncheon

AT the annual luncheon of the Radio Communication and Electronic Engineering Association held recently at the Piccadilly Hotel, London, the retiring chairman, Mr. L. H. J. Phillips, replying to the toast of the industry proposed by Mr. L. T. Hinton, said that the Council's main concern last year had been with the impact of the rearmament programme on the industry. The real problem had been to ascertain exactly what was the rearmament programme. They wanted the answer in industrial terms which they could understand and use in their very necessary planning and not in the " global " terms which the Government rightly used. The formation of the Supply Minister's Radio (Rearmament) Advisory Committee, if it had done nothing else, had brought together the two different points of view, and Government–industry co-operation of a high order had been established now that each side had been told and appreciated the problems of the other. The immediate apparent result had been the initiation of a spate of fact-finding activity, a good deal of which was being left to industry to deal with. The final industry mechanism for this had yet to be evolved.

On the export activity of R.C.E.E.A. members, Mr. Phillips said that Customs and Excise figures showed direct exports to have risen from £1 million in 1946 to £6 million per annum in 1951. This took no account of indirect exports.

Mr. Ivor R. Cox, managing director, Metropolitan-Vickers Electrical Co., Ltd., replied to the toast of the guests.

Import—Export Classification

Traders' Responsibility for Accurate Returns

By JOHN C. HANCOCK

EARLY in each New Year an official notice is issued by H.M. Customs and Excise drawing the attention of importers and exporters to new editions of the Import and Export Lists.* This routine announcement stresses that all goods entering or leaving the country "should be described on the relative import and export documents on uniform lines and in accordance with a standard nomenclature." The official lists are designed to achieve this end since the details given by traders in their import and export documents form the basis of our external trade returns, which are compiled by the Statistical Office of H.M. Customs and Excise.

Readers will no doubt have noticed that month by month overseas trade statistics form a regular feature of the *Electrical Review* but possibly not all importers and exporters who study them know exactly how they are obtained or realize that these figures are compiled from information which they themselves are required to give every time they import or export goods.

Arrangement of Lists

Revised regularly and published annually under the joint authority of the Treasury and the Customs and Excise, the Import and Export Lists set out under general groupings the specific headings appropriate to each class of article, and against each heading the corresponding unit of weight, measure or quantity. The 1952 editions contain no amendments affecting electrical goods. The main classification of goods follows the same pattern in both Import and Export Lists, namely:—(I) Food, drink and tobacco; (II) Raw materials and articles mainly unmanufactured; (III) Articles wholly or mainly manufactured; (IV) Animals not for food; and (V) Parcel post.

Each of these classes is broken down into groups. The electrical items fall naturally into Class III: *Articles wholly or mainly manufactured*, and are to be found chiefly under two headings: *Group "F"—Electrical goods and apparatus* and *Group "G"—Machinery and parts thereof*. So far no separate group has been raised for electrical machinery, an omission which merits some consideration by the Revising Committee.

Other Electrical Equipment

There are in addition a number of electrical items which are divorced from their apparent parent headings, such as porcelain insulators, which are grouped in "B" under *Pottery, glass and abrasives*, bare copper wire which comes under "D" *Non-ferrous metals and manufactures thereof* and vacuum cleaners which are found in the machinery group ("G").

While the general headings for electrical goods within Group "F" are common to both the Import and Export Lists the individual items in this group do not necessarily run on identical lines. Thus the item *Electric cables, wires, strips and strands* is subdivided quite differently. In the Import List one subdivision is that of *Cable core produced by stripping used submarine cables*, a description which is missing in the Export List. Similar variations appear throughout the remaining items which go to make up the Group *Electrical goods and apparatus*.

From the Customs point of view the rendering of the "relative import document" is not an action that can be evaded, or overlooked, for the simple reason that the importer will not be able to clear his goods through the Customs unless he does make the appropriate entry. Since the entry, more often than not, is required to assess the amount of duty payable, any discrepancies are usually pointed out by the Customs authorities.

The exporter, on the other hand, shipping

* Import List, 1952, No. 31 (Sale), price 3s; Export List, 1952, No. 33 (Sale), price 2s 6d. From H.M. Stationery Office.

goods for which no export licence is required, or which do not otherwise have to be pre-entered, can fairly easily omit to render the "relative export document." This document consists of a specification or shipping bill which the exporter, or an agent acting on his behalf, is required under the Customs and Inland Revenue Act, 1881, "to lodge on the appropriate form either before shipment or within six days of the final clearance outward of the exporting vessel." Specifications covering goods exported by air must always be lodged before loading.

Export goods subject to any licensing restrictions have to be pre-entered on a shipping bill, which is in effect another type of specification. Goods destined for countries outside the sterling area have also to be pre-entered—for exchange control purposes—and goods exported under drawback or consigned from a bonded warehouse have also to be pre-entered on the appropriate shipping bill. Eventually all the specifications and shipping bills lodged at the various docks up and down the country, and airports, are sent to the Statistical Office of the Customs and Excise in London where the information contained therein is tabulated and classified for publication.

The wide range of goods covered and the seventy-odd countries from which and to which we draw our imports and send our exports impose a limit on the amount of detail which can be conveniently published. A reasonable breakdown of the figures can be obtained from the monthly "Accounts relating to the Trade and Navigation of the United Kingdom" and the "Annual Statement of Trade of the United Kingdom."

Additional Information

Traders who require to know, for example, how many electric toasters were exported to Ethiopia over a given period, or the value of electrical porcelains imported from Germany or Japan during another period, can obtain, on payment of a small fee, such information by means of a bill of entry return by applying direct to the Statistical Office of the Customs and Excise. Unless items are specifically shown in either the Import or Export Lists the Statistical Office will not be able to supply any detailed figures. For example, no figures can be extracted from the trade returns in respect of heating pads and blankets, since these are not separately listed, nor do electric cable junction boxes appear in either publication.

Importance of Accuracy

The importance of accuracy in the compilation of our overseas trade statistics cannot be overstressed. They are used extensively by Government Departments, especially the Treasury, who rely on them to keep a check on our balance of payments situation. Not only must the figures be accurate but they must be prompt as well, for as soon as figures become "historical" they lose their value. They are also used as a basis for negotiating trade agreements with other countries, and they are valuable to the trading community as a whole.

An indication that all importers and exporters are not fully aware of the importance of rendering correct returns may be gained from the fact that the Statistical Office has to refer back to the trading community a steady average of between four and five hundred serious queries a week, either because the forms are not filled in correctly, or because they lack some essential information. Thus, a responsibility rests on every trader or manufacturer who engages in overseas trading to ensure, first, that his own staff is made aware of the necessity for accuracy in trade statistics, and secondly that when engaging the services of a shipping agent the relevant information is provided in order that he can make out a correct entry on his principal's behalf.

Some "snags," especially on the export side, do arise. For instance, the practice varies from port to port as to the responsibility for making the necessary entries. In Liverpool the person who delivers f.o.b. is responsible for making the entry; in London the obligation rests with the person who pays the sea freight. From these simple facts one can see how easily mistakes can arise. Two specifications can be lodged for the same shipment, or no specification lodged at all, until the exporter receives a note from the Customs, some weeks later, reminding him that no specification has been rendered in respect of a certain shipment, and drawing his attention to the fact that he may be liable to a fine of £5 if he fails to comply within a given period. (In practice this fine is not

imp ed in cases of inadvertent omission.) The information to be shown in specification and shipping bills has been reduced to a minimum, but that does not lessen their importance, because all the information is needed for a specific purpose. The shipping marks and numbers and description of goods are called for because from these details a particular consignment appearing in the ship's manifest is identified.

As we have already seen, goods have to be described and classified in accordance with the headings indicated in the official lists. In addition, the trade names or descriptions under which the goods are generally known should be given. Thus a shipment of electric fires should appear on the " relevant export document " in this manner:—

> 10 cases: " Glow-warm " electric fires.
> Class III, Group " F, " Electrical heating appliances other than radio frequency, complete; space heating appliances.

followed by the quantity and f.o.b. value to the nearest pound. A point worth noting is that the value to be shown on the export specification is the f.o.b. value, while that on the import entry is the c.i.f. value, a factor which is not always appreciated when a comparison between our export and import trade figures is made over a given period.

The nationality of the carrying vessel has also to be shown since this gives an indication of the amount of " invisible " currency earnings accruing to the country by way of freight charges when goods are carried in British registered vessels.

In the case of exports, the final destination of the goods must always be shown though the port at which the goods are unshipped may not necessarily indicate this. For example, goods may be offloaded at Beira or Lourenço Marques in Portuguese East Africa, for final delivery to Southern Rhodesia or the Union of South Africa. Similarly, the port from which goods are consigned, in the case of imports, may not indicate the country of origin of the goods.

The statistical activities of the Customs and Excise have earned them a high reputation for accuracy and promptness not only in this country but in countries overseas and many have modelled their statistical departments on our own lines. The maintenance of this reputation depends in the first instance on the co-operation of all importers and exporters, and of agents acting on their behalf.

Canadian Electrical Manufacture

PRODUCTION by firms in the electrical apparatus and supplies industry in Canada was valued at about $581 million in 1950, an increase of 19 per cent on the previous year's total. In amplification of the summary given on page 1312 of the *Electrical Review* of 28th December last, the table below gives the selling value at works of the principal items.

Of the generators built the majority (valued at roughly $11 million) were a.c. of 1,001 kVA and above. Of the motors nearly $14 million represented single-phase induction machines of ¼ h.p. and under; $4 million polyphase induction 1 h.p. to 5 h.p.; just over $3 million polyphase induction 6 h.p. to 25 h.p.; and about $3 million railway and vehicle motors. The wire and cable group's production rose in value to not far short of one-sixth of the total of all electrical apparatus and supplies. It included a large proportion of aluminium and a.c.s.r. conductors, though less than in 1949; at the same time increases were shown in the output of thermoplastic wires and cables and enamelled magnet wires.

Class of Goods	$ (000) 1949	$ (000) 1950
Generators and parts	8,197	12,344
Convertor equipment	1,720	2,898
Lamps, standard sizes	7,823	10,858
Lamps, miniature	2,253	2,512
Lamps, fluorescent	3,383	4,111
Lighting fixtures	14,493	19,329
Washing machines, electric, domestic	27,958	27,160
Furnaces	403	365
Industrial ovens	937	1,575
Watt-hour meters	7,205	6,668
Wires and cables	85,785	90,859
Motors and parts	27,005	35,445
Industrial control equipment	8,072	7,808
Radio receiving sets (civilian)	29,412	33,498
Radio valves	3,305	5,871
Television sets	2,010	7,765
Refrigerators, electric, domestic	36,736	66,033
Refrigerators, electric, other	16,673	53,409
Transformers and parts	35,525	38,785
Telephone material	32,531	29,720
Vacuum cleaners and parts	7,808	8,541
Stoves over 35 A	19,472	23,491
Rangettes	2,322	1,677
Grills, etc.	1,246	1,038
Electric flat irons	2,325	2,722
Electric toasters	2,481	1,827
Water heaters	1,365	1,658
Switchgear and protective equipment	26,974	29,787
Wiring devices	12,415	14,805
Welding apparatus	2,718	2,907
Batteries, storage	15,288	17,105
Batteries, dry cell	8,285	8,747
Apparatus and parts not elsewhere specified	33,566	34,756

ELECTRICITY SUPPLY

Load Spreading Modified in Scotland

Steel Shortage Delays Power Schemes

THE chairman of the Scottish Board for Industry (Mr. C. Murdoch) announced last week that staggered hours in industry, brought in to avoid power cuts, are to end in Scotland to-day (Friday) and normal working will be resumed next Monday. He said that no actual cuts had been necessary so far this winter, although voltage reductions had been made, and he hoped that the conditions would remain favourable. The new arrangement, however, was subject to weekly review. The Board had decided that the reduction in industrial consumption compared with the corresponding period of last year should be at the rate of 10 per cent instead of 20 per cent. Industry and commerce, he said, had made a very fine response to the load spreading appeal.

The Electricity Committee of the East and West Riding Regional Board for Industry is also seeking power to end load spreading before 31st March if conditions are favourable.

Power Station Construction Delayed

Although contracts have been placed for the construction of the new power station at Blaydon, in the B.E.A. North Eastern Division, little or no progress has been made because of the shortage of steel. This was stated last week by an official of the Division. He said that the allocation made was only 25 per cent of the amount required during the next three months and the Ministry of Supply had been asked to increase it. The shortage of steel reinforcement bars would materially affect the date of completion.

In Cardiff recently Mr. Bennett, the South Wales divisional controller, said that steel shortage was holding up the construction of the power station at Carmarthen Bay.

S.W. Scotland Commercial Tariff

When the introduction of new standard industrial tariffs in S.W. Scotland was announced last November (with effect from 15th December) it was stated that consideration was being given to the standardization of commercial and public lighting charges. In a letter to the Glasgow Chamber of Commerce last week Mr. W. Hutton, deputy chairman of the S.W. Scotland Electricity Board, said that proposals had been submitted to the Consultative Council for the simultaneous increase and standardization of the commercial tariff. The Council had asked the Board for the reasons for the increase, the effect of application, and for a comparison with the rates being paid by other classes of consumers, and this information would be provided. The proposals were on the lines of the industrial tariffs, with certain modifications. In the block tariff, the commercial consumer would pay 4d/kWh for the first 50 kWh supplied in each quarter (against the industrial 100 at 2d); in the two-part tariff, the commercial maximum demand would be based on a 12-month period instead of one month and the adjustment for power factor would be omitted. The increase would fall more heavily on Glasgow consumers because the city had enjoyed lower tariffs, but a " cushion " would be provided for the first year by allowing consumers to buy at 1·4d/kWh instead of at 1·65d. About 52,000 consumers would find their tariffs up, while about 20,000 would have them reduced.

Capital for Rural Supplies

A resolution " That this Council strongly press in the forthcoming financial year that the Southern Electricity Board should allocate to agricultural development, including farm workers' cottages, a fair proportion of the capital allowed for new business " was unanimously approved at last week's meeting of the Southern Electricity Consultative Council at Reading. Mr. A. Lockwood (chairman of the Council) presided.

N.C.B. Tariffs

Mr. W. R. Blyton, M.P. for Houghton-le-Spring, has taken up with the National Coal Board complaints by people living at Herrington that non-miner electricity consumers supplied by the Durham Division are charged 10 per cent more than miners for the service. Mr. Blyton has been informed by the Minister of Fuel that the Electricity Acts prohibit discrimination. Before nationalization of the mines, the electricity was supplied by Lambton, Hetton and Joicey Collieries, Ltd., without discrimination.

Skye Cable Repaired

The cable connecting the Isle of Skye to the mainland having been repaired, the electricity supply was restored on 14th January. The breakdown occurred on 30th December when a ship's anchor cut the cable.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Electric & Musical Industries, Ltd., is offering to ordinary stockholders 1,741,724 new ordinary shares of 10s each at the price of 12s 6d per share on the basis of three new ordinary shares for each ten units of ordinary stock held. It is intended to convert the new ordinary shares into stock, and they will rank *pari passu* in all respects with the existing ordinary stock. After providing for underwriting and other expenses of the issue, the net proceeds will amount to approximately £1,046,000 which will be applied in reduction of the bank overdraft. The issue is being underwritten by Edward de Stein & Co. and Morgan Grenfell & Co., Ltd.

A. C. E. C. (Ireland), Ltd.—On Monday last £150,000 in 6 per cent cumulative preference shares were offered in Dublin by A. C. E. C. (Ireland), Ltd. The parent company, Ateliers de Constructions Electriques de Charleroi, of Belgium, has agreed to give technical advice and assistance over the next few years and a new factory costing over £250,000 has been built and equipped at Waterford. It is hoped to begin activities early in February, the production consisting of transformers ranging from 3.5 to 1,000 kVA, and motors ranging from 0.33 to 40 h.p.

Directors of the Belgian company and their friends have taken up the entire ordinary share issue of the Irish company—100,000 "A" shares of 1s each (£5,000) and 2,900,000 "B" shares of the same value (£145,000). The board of A. C. E. C. (Ireland) will consist of four directors—two Belgians, M. Georges Cauchie and M. Georges Marchand (managing director), and two Irishmen, Mr. William P. Ganley, director of the Bank of Ireland, and a Dublin solicitor, Mr. Arthur Cox.

Radio Rentals, Ltd., reports a net profit for the year ended 31st August last of £157,434, as compared with £153,256 for the preceding year. The group net profit is £172,150 (against £171,952). In addition £27,440 (provisions made in previous years, mainly for taxation, no longer required) is replaced in the profit and loss appropriation account. The final ordinary dividend is 20 per cent, maintaining the distribution for the year at 30 per cent.

Dussek Brothers & Co., Ltd., report a net profit for the year to 31st October last of £96,188, as compared with £71,557 for the preceding year. After deducting £55,795 for taxation, and placing £22,400 to reserves, it is proposed to pay a final ordinary dividend of 16½ per cent, making 22½ per cent for the year. The balance carried forward is £93,318 (against £89,104 brought in).

In his statement which accompanies the report and accounts, Mr. L. J. Dussek (chairman) says that the directors have considered the manufacture of the company's products in Australia, and negotiations are at an advanced stage for a link-up with an established Australian company.

Cable & Wireless (Holding), Ltd., in a preliminary statement, reports a profit, before taxation, for 1951 of £541,000, as compared with £369,000 for 1950. United Kingdom taxation absorbs £216,000 (against £187,000), leaving a net balance of £325,000 (against £182,000). It is proposed to place £100,000 to general reserve and to pay a dividend of 6 per cent and a bonus of 2 per cent, both less tax, on the ordinary stock (against a total distribution of 6 per cent for the previous year).

The Direct Spanish Telegraph Co., Ltd., reports a net profit for 1951 of £4,300, as compared with £4,057 for 1950. It is proposed to pay a dividend for the year of 4½ per cent (unchanged), and in addition to pay a special bonus of 5 per cent.

The Globe Telegraph & Trust, Ltd., has declared an interim ordinary dividend of 3 per cent (against 2½ per cent).

New Companies

Venner Time Switches, Ltd.—Public company. Registered 17th January. Capital £100. Electrical, mechanical and general engineers, machinists, fitters, etc. Directors: A. A. Rowse and J. M. Brooke, directors of Venner, Ltd., Venner Accumulators, Ltd., etc. Regd. office: Kingston By Pass Road, New Malden, Surrey.

Rivlectric, Ltd.—Registered 19th January. Capital £1,000. Manufacturers of and dealers in electrical, gas and oil lamps, etc. Directors: J. N. Somers, M. A. Rivlin and M. Black. Regd. office: 6, Clarence Road, Hunslet, Leeds.

W. L. Pitcher, Ltd.—Registered 21st January. Capital £4,000. Electrical contractors and engineers, radio, ventilating and

refrigerating engineers, etc. Directors : Mrs. Elsie L. Pitcher and W. P. Yates. Regd. office : 304, Cheriton Road, Folkestone, Kent.

A. & A. Ashworth (Electrical Contractors), Ltd.—Registered 18th January. Capital £2,000. To acquire from Albert Ashworth the business of electrical contractors and retailers carried on by him under his own name and as " Chadderton Radio and Electrical Services " at 180, Chadderton Road, Oldham. Directors : A. Ashworth and Amy Ashworth. Regd. office : 180, Chadderton Road, Oldham.

B. W. Swainson, Ltd.—Registered 22nd January. Capital £1,000. Electricians, electrical contractors and mechanical engineers, manufacturers of and dealers in electrical apparatus, television and radio, etc. Directors : B. W. Swainson and Mrs. I. Swainson. Secretary : Annie Royle. Regd. office : 465, Barlow Moor Road, Chorlton cum Hardy, Manchester, 21.

Moyle & Johns (Engineers), Ltd.—Registered 18th January. Capital £10,000. Electrical engineers, general electrical installation contractors, lighting specialists and contractors, radio and television engineers, etc. Directors : F. G. Moyle, Mrs. Winifred Moyle and G. S. Johns. Regd. office : 93, Meneage Street, Helston, Cornwall.

Thames Side Electrical Services (Staines), Ltd.—Registered 16th January. Capital £1,000. Electrical contractors and engineers, etc. Permanent directors : H. M. Pollen and Teresa M. Little. Secretary : H. M. Pollen. Regd. office : 51, Thames Street, Staines, Middx.

Increases of Capital

Morphy-Richards, Ltd.—Increased by £130,000, in £1 6 per cent redeemable cumulative convertible preference shares, beyond the registered capital of £200,000.

Parmiter, Hope & Sugden, Ltd.—Increased by £40,819 12s, in 1s ordinary shares, beyond the registered capital of £138,339.

Premier Electric Heaters, Ltd.—Increased by £25,000, in £1 ordinary shares, beyond the registered capital of £100,000. At 21st December, 1951, Associated Electrical Industries, Ltd., held practically all the issued shares.

Quasi-Arc Co., Ltd.—Increased by £850,000, in £1 shares, beyond the registered capital of £400,000. At 29th March, 1951, the British Oxygen Co., Ltd., held practically all the issued shares.

Acru Electric Tool Manufacturing Co., Ltd.—Increased by £4,900, in £1 ordinary shares, beyond the registered capital of £100.

Bankruptcies

R. Davidson, Sea Links, Chyngton Road, Seaford, Sussex, formerly of 41, Brangwyer Road, Seaford, and carrying on business at 199, High Street, Lewes, as an electrical illuminating engineer.—Last day for receiving proofs for dividend 8th February. Trustee, Mr. J. S. Bradley-Hole, 7, Old Steine, Brighton.

W. B. Johnson, 18, Elm Park Road, Wallasey, Ches., electrician, and lately carrying on business at 114a, Brighton Street, Wallasey, under the style of " Fluorescent Neon Display Co.," as a manufacturer and retailer of neon lights.—Last day for receiving proofs for dividend 12th February. Trustee, Mr. R. P. Booth, 5, Rumford Place, Chapel Street, Liverpool, 3.

Liquidation

C. M. C. (Switchmatic), Ltd.—In voluntary liquidation. Particulars of claims by 29th February to the liquidator, Mr. J. S. Bradley-Hole of A. E. Orbell & Co., 7, Old Steine, Brighton.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 23rd February.

EE (design). No. 697,115, Class 7. Compressors (machines), electricity alternators, electricity generators; electric motors, internal combustion engines and turbines, none being for land vehicles; and electromagnetic couplings for machinery, feedwater heaters, gearing (not for land vehicle propulsion systems), pumps included in Class 7, steam condensers, washing machines and electric food-mixing machines; and parts included in Class 7. EE (design). No. 697,206, Class 9. Calculating machines, condensers, convertors, counting apparatus, current rectifiers, discharge tubes (not for lighting purposes), kitchen appliances included in Class 9, flat irons, vacuum cleaners, induction apparatus, relays, resistances, safety-fuses (cut-outs), signalling apparatus, switches, switch-boards, transformers and welding apparatus (other than machines), all being electric; electric apparatus and instruments for measuring, indicating and testing; electric apparatus for controlling machines, engines and motors by current control; systems for the transmission of electric current; radio apparatus; and component parts included in Class 9. EE (design). No. 697,207, Class 11. Air cleaning apparatus, cooking stoves, electric drying apparatus (other than machines), electric heating, lighting, refrigerating and ventilating apparatus, electric kitchen utensils included in Class 11 and component parts included in Class 11, but not including glass lampshades or goods of the same description. EE (design). No. 697,208, Class 12. Aircraft, electric motor vehicles, locomotives, tramcars, gearing for land vehicle propulsion systems, i.e. engines for land vehicles, turbines for land vehicles, and component parts included in Class 12.—English Electric Co., Ltd., Queen's House, 28, Kingsway, London, W.C.2.

DIXOCLENE. No. 699,113, Class 7. Floor polishing and cleaning machines, scrubbing machines, squeegee machines, carpet cleaning machines, machines for spraying polish and carpet shampooing machines, all being electrically operated (not for domestic use).—R. G. Dixon & Co., Ltd., Capitol Works, Empire Way, Wembley, Middlesex.

RIA. No. 701,151, Class 9. Electrical apparatus included in Class 9 for the regulation or control of heating or cooling apparatus: impulse transmitters, being electrical apparatus: and intermittently illuminated signs.—Landis & Gyr A.G., Zug, Switzerland. Address for service, c/o D. Young & Co., 29, Southampton Buildings, Chancery Lane, London, W.C.2.

STOCKS and SHARES

THIS momentous week has found Stock Exchange markets in a state of tension which was partly relaxed, of course, by the unravelling of the second part of the Government's financial policy by the Chancellor of the Exchequer. There is still the Budget to come, so that the period of suspense can hardly be said to have ended yet. Immediately before Mr. Butler's statement, most prices round the Stock Exchange markets had shown a dull tendency. Compared with the prices of a month ago, substantial falls are seen in many cases. Reference to the table overleaf shows that the depression has been considerable, and this, it must be remembered, follows upon an earlier general decline in values. Reasons for the falls have been set out here at some length during the past few weeks; the country does now seem to have had brought home to it the gravity of the situation, and the importance of the steps which the Government is making to bring about an improved state of affairs.

Cable & Wireless Dividend

The Cable & Wireless (Holding) Company, now an investment trust, provided markets with at least one item of good cheer last week in declaring, very unexpectedly, a 2 per cent bonus in addition to an ordinary dividend at the same rate as last year's 6 per cent. The news was welcomed by a jump of 10 points in the price of the ordinary stock, to 125½, reduced later by the amount of the fraction. Allowing about 4 points for the net value of the dividend and bonus in the price, the stock now gives a return of 6⅔ per cent on the basis of the total distribution of 8 per cent. The preliminary profit figures supporting the announcement also made a good impression, as did the difference (in favour) of nearly a million between the book value of the quoted investments and their market value at the end of the year: Globe Telegraph shares put on 6d, as an interested party, to 26s 6d.

E.M.I. New Shares

Dealings began early this week in the 1,740,000 Electric & Musical new 10s ordinary shares at a premium of 2s 6d on the price of 12s 6d at which they are offered to present shareholders. The old shares were quoted 15s ex-rights to the issue. A statement by the company says that although the current year's profits may fall below the previous record level, there should be ample margin to maintain the 12 per cent dividend, barring factors outside the board's control. This means that the shares are on a yield basis of 8 per cent, which gives point to the question, very much under discussion just now, as to whether these big new issues are going to put further pressure on yields over a wide field of industrial investments. Reasons for the issue are given as the rise in overdrafts from a half to two and a half millions, in the first five months of the financial year, which has accompanied the expansion of 26 per cent in the turnover of the English companies, and of 33 per cent in that of the overseas group. This issue is another case where shareholders are invited to subscribe for "excess" shares, which will, obviously, be well worth having at the premium mentioned above.

Aerialite Yield

A prospective yield of a florin over 10 per cent is shown by the 1s ordinary shares of Aerialite, Ltd., at their present price of 8s 9d, and assuming the maintenance of the 88½ per cent dividend paid for the year ended last May. Turnover of the group in that period was nearly 50 per cent higher than in the preceding twelve months, and net profits rose to £58,000, equivalent to gross earnings of 180 per cent on the then ordinary capital. The latter has since been increased to a total of £75,000 by a cash issue of ordinary shares, after the close of the last accounts. With a simultaneous issue of preference shares, this raised some £120,000 new money, and has been proved a timely operation by subsequent events in the new issue market. The name Aerialite is associated largely in the public mind with radio antennae, but it is evident from the report that electric and other forms of cable represent the most important side of the group's production. According to the chairman, the current year opened with turnover and profits still rising.

New Issue Prospects

Allotment letters in connection with the issue of nearly 2½ million shares by Associated Electrical Industries were expected to be in the hands of existing shareholders to-day (Friday), or over the week-end. Although the old shares remained depressed in advance of the event, a substantial premium on the offered price of 60s seemed assured for the newcomers, a point which should not be overlooked in connection with the shareholders' entitlement to apply for any excess shares not claimed by way of rights. Allotment letters for the larger issue of ten million new ordinary shares by Imperial Chemical Industries are due to appear on 16th February. With the existing shares quoted at present about eighteenpence above the issue price of 40s 6d,—the basis being one new share for six old shares held—the value of the rights would work out at a few pence. Their actual value will naturally depend upon the movement of prices during the two weeks' interval expected to be made eventful by Mr. Butler.

Electrical Investments

Past Month's Price Changes

Company	Dividend Pre-vious	Dividend Last	Middle Price Jan. 25 1952	Month's Rise or Fall	Est. Yield p.c.
Overseas Electricity Companies					£ s. d.
Atlas Elec. ..	3	4	19/-	−9d	4 4 3
Calcutta Elec. ..	6†	6†	20/6	+6d	5 17 1†
Cawnpore Elec. ..	—	—	28/9	−2/-	—
East African Power	7	7	31/9	−1/9	4 8 2
Jerusalem Elec. ..	—	—	10/-	—	Nil
Madras Elec. ..	—	—	25/-	−2/6	—
Nigerian Elec. ..	10	10	28/-	−1/-	7 2 10
Palestine Elec. "A"	5†	5†	16/-	−6d	6 5 0†
Perak Hydro-Elec.	Nil	Nil	12/6	+1/-	—
Equipment and Manufacturing					
AberdareCables(5/-)	20	20	12/6	−1/3	8 0 0
Aerialite (1/-) ..	83½	88½	8/9	—	10 2 0
Aron Elec. Ord. ..	15	15	35/-	−5/-	8 11 6
Assoc. Elec. Ord.	15	20	72/6	−11/3	5 10 4
AutomaticTel.& El.	12½	15	56/3	−7/6	5 6 9
Babcock & Wilcox	15	18	66/6	−4/-	5 8 5
Baldwin, H. J. (2/-)	25	25	5/-	—	10 0 0
British Aluminium	10	10	36/9	−2/6	5 8 10
B.I. Callender's ..	6⅔	7½	28/-	−2/-	5 7 2
British Thermostat (5/-)	30	30	27/6	−3/9	5 9 1
British Vac.Cleaner (5/-)	20	25	14/-	−1/3	8 18 6
Brush Ord. (5/-) ..	10	10	6/-	—	8 6 8
Burco (5/-) ..	42½	38¾	20/-	−1/3	9 11 9
Chloride El.Storage	12½	15	58/9	−3/9	5 2 0
Cole, E. K. (5/-) ..	20	25	16/-	−2/-	7 16 4*
Cossor, A. C. (5/-)	Nil	Nil	12/6	−1/6	—
Crabtree (10/-) ..	17½	17½	33/-	−1/6	5 6 1
Crompton Parkinson Ord. (5/-) ..	22½	11½*	9/3	−9d	6 1 8
De La Rue (5/-) ..	50	50	28/9	−2/-	8 13 8
Decca (1/-) ..	112½	112½	16/-	−1/-	7 0 8
E.M.I. (10/-) ..	8	12	16/6	−1/6	7 5 6
Electrical Components (5/-) ..	20	20	11/3	—	8 17 10
Elec. Construction	15	15	50/-	−7/6	6 0 0
Enfield Cable Ord.	7½	7½	26/-	−1/6	5 15 5
English Electric ..	10	15	56/3	−2/6	5 6 9
Ericsson Tel. (5/-)	20†	22†*	38/9	−3/3	2 16 8†
Ever Ready (5/-)	35	35	26/6	−1/6	6 12 1
Falk Stadelmann	15	15	40/-	−1/3	7 10 0
G.E.C. Ord. ..	17½	22½	82/6	−9/-	5 9 0
General Cables (5/-)	38	30*	17/6	—	8 11 6
Greenwood &Batley	15	15	47/6	−2/-	6 6 4
Hackbridge Cable (5/-)	20	20	10/3	−6d	9 15 2
HackbridgeHewittic (5/-)	15	18	16/3	—	5 11 7
Hall Tel. Acc. (10/-)	10	10	12/-	—	8 6 8
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (5/-) ..	20	20	19/6	−1/6	5 2 7
Hoover (5/-) ..	45	30*	25/3	−2/-	5 18 10
Intl. Combustion (5/-)	21	20*	19/3	+6d	5 4 0
Johnson & Phillips	15	15	50/9	−5/6	5 18 1

Company	Dividend Pre-vious	Dividend Last	Middle Price Jan. 25 1952	Month's Rise or Fall	Est. Yield p.c.
Equipment and Manufacturing (continued)					£ s. d.
Lancashire Dynamo	22½	22½	40/9	−3/-	5 16 1*
Laurence,Scott(5/-)	12½	12½	11/9	−6d	5 6 5
London Elec. Wire	10	10	40/-	−2/6	5 0 0
J. Lucas	17½	7½*	32/6	−3/9	4 12 4
Mather & Platt ..	11	12½	40/9	−3/-	6 2 6
Metal Industries ..	10	10	35/9	−3/3	5 11 9
Mid. Elec. Mfg. ..	12½	15	60/-	—	5 0 0
Murex	10	12½	51/6	−1/6	4 17 0
Newman Ind. (2/-)	10	6	2/9	—	—
Oldham & Son (1/-)	30	30	4/-	−3d	7 10 0
Parsons, C. A. ..	15	15	45/9	−4/3	3 5 6*
Plessey (5/-) ..	20	22½	19/-	—	5 17 0
Pye Deferred (5/-)	35	18*	17/-	−2/-	5 6 0
Revo (10/-) ..	27½	27½	38/9	−2/-	7 1 10
Reyrolle	15	15	42/-	−1/-	3 11 5*
Scot. Cable (4/-) ..	30	30	20/3	+3d	5 18 5
Siemens Ord. ..	7½	10	36/3	−3/3	5 10 4
Switchgear&Cowans (5/-)	20	22½	13/6	−1/6	8 6 8
T.C.C. (10/-) ..	15	20	45/-	+1/3	4 9 0
T.C. & M. ..	9*	10*	36/3	−2/6	5 10 4
TelephoneMfg.(5/-)	10	10	8/6	−6d	5 17 8
Thorn Elec. (5/-)..	20	10*	9/-	—	5 11 1
Tube Investments	25	25	5⅛	−8/9	4 18 5
Vactric (5/-) ..	Nil	Nil	6/3	−2/-	—
Veritys (5/-) ..	2½	Nil	3/9	—	Nil
Walsall Conduits (4/-)	70	70	51/3	−5/-	5 9 2
Ward & Goldstone (5/-)	44	45*	41/6	—	5 8 5
Watford (2/-) ..	20	25	6/-	−3d	8 6 8
WestinghouseBrake	14	14	50/-	−3/9	5 12 0
West, Allen (5/-)..	10	12½	10/9	—	5 16 3
Transport and Communications					
Anglo-Am. Tel.: A Ord.	—	—	87½	−3	—
Ord.	—	—	60	—	—
Anglo-Portuguese	8	8	22/6	—	7 2 3
Brit. Elec. Traction: Def. Ord. ..	22½	25	405	−30	6 3 5
Cable & Wireless: Ord.	6	8	125	+7½	6 8 0
4% Loan ..	4	4	95	—	4 4 3
Calcutta Trams ..	6†	6†	24/6	−1/-	4 18 0†
Cape Elec. Trams	4	5	15/-	−6d	6 13 4
Globe Tel. & Tel. Ord.	—	—	26/6	+6d	5 5 8
Great Northern Tel. (£10)	7½	8	10	−10/-	8 0 0
Inter. Tel. & Tel.	Nil	15cts	35	+3	—
Marconi Marine ..	7½	10	36/-	−1/6	5 11 1
Oriental Tel. Ord.	16	16	43/9	−3/9	—
Telephone Props.	7	8	31/3	−2/6	5 2 5
Tele. Rentals (5/-)	10	10	9/-	—	5 11 1

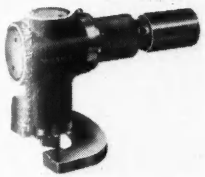
* After capital bonus.
† Dividends are paid free of Income Tax.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Flexible Shaft Driven Shearer

THE latest addition to the range of equipment made by E. C. HOPKINS, LTD., Grosvenor Street West, Birmingham, 16, is a shearer which has been designed primarily for use with the company's models Z6 and Z6A multi-speed



Hopkins flexible shaft driven shearer

flexible shaft machines. Although it weighs only 2 lb it can cut 18 s.w.g. steel and has a rate of 900 to 1,600 cuts/min and a radius of cut of 1·5in.

Multi-Coloured P.V.C. Wires

The development of light-fast pigments and lacquers which are highly resistant to abrasion and to most corrosive acids and solvents, has enabled TENAPLAS, LTD., Upper Basildon, near Pangbourne, Berks, to produce p.v.c. insulated wires with two-colour identification. All standard gauges of wire, both single- and multi-stranded, are being produced with p.v.c. insulation of all thicknesses with a lacquer spiral for identification purposes. The colours of both the p.v.c. base and the lacquer spiral can be varied to suit individual requirements.

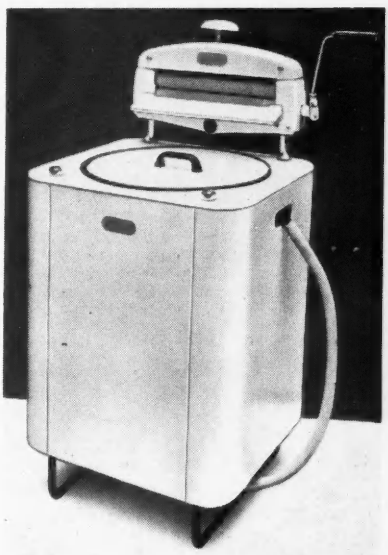
Cathode Ray Tube for Oscillography

A new type of cathode ray tube, 908 C.A.R.A., is announced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, for use in high speed oscillography. It uses electrostatic focusing and deflection, and has a 9 cm diameter flat-faced screen coated with a highly actinic powder giving a blue fluorescence. On stage of post-deflection acceleration is employed, which enables the beam to be accelerated after the main deflection has taken place. Connections to the front plates are brought out of the envelope via side arms, while the connections to the back plates and the third anode are taken through the base. The operating conditions are: heater voltage, 4 V; heater current, 1·1 A; first anode voltage, 2 kV; second anode voltage (focus), 220 V; third anode voltage, 4 kV; post-deflection accelerator voltage, 8 kV; cut-off voltage, 70 V; and back and front plate sensitivities, 0·11 mm/V and 0·08 mm/V respectively.

Washing Machine

Between 6 and 7 lb of dry clothes can be dealt with at a time by a washing machine being sold for £28 (plus £12 1s purchase tax in the United Kingdom) by the LONGFORD ELECTRIC CO., 8, Grosvenor Street, Manchester, 1. A tubular frame construction has been adopted with a vitreous enamelled pressed steel body, the corners of which are rounded. The aluminium tank is resiliently mounted; the four-blade agitator has smooth edges and is easily removable for cleaning. The hand wringer, which has 14in solid rubber rollers, is also removable and is adjustable for pressure. The overall dimensions, excluding wringer, are 32in high, 22½in wide and 20½in deep.

Longford washing machine



NEXT WEEK'S EVENTS

Monday, 4th February

CHESTER.—Town Hall, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Economics of L.V. Supplies to New Housing Estates," by F. G. Copland.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North-East London Branch. "The High Rupturing Capacity Fuse and its Scope," by A. Crinson.

IPSWICH.—Crown and Anchor Hotel, 6.30 p.m. Institution of Electrical Engineers. District meeting. Lecture on "Modern Developments in Electric Welding," by Dr. H. G. Taylor.

LEEDS.—Great Northern Hotel, Wellington Street, 7.30 p.m. A.S.E.E. Leeds Branch. "Textile Electrification," by R. Spence.

LONDON.—Savoy Place, W.C.2, 7 p.m. I.E.E. London Students' Section. The Students' Lecture. "Electromagnetism and Engineering Research," by Dr. K. J. R. Wilkinson.

MAIDSTONE.—New Inn, Sandling Road, 7.30 p.m. Institution of Electrical Engineers. District meeting. "The Electrophonic Organ," by L. E. A. Bourn.

NEWCASTLE-ON-TYNE.—King's College, 6.15 p.m. I.E.E. North-Eastern Radio and Measurements Group. "An Investigation into the Mechanism of Magnetic-Tape Recording," by P. E. Axon.

NORWICH.—Royal Hotel, 7.30 p.m. Institution of Electrical Engineers. District meeting. "The Phase/Neutral System of Supply for Rural H.V. Distribution," by G. T. Garwood and G. J. Websdale.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Electronics in Industry," by Mr. MacDonald.

STAFFORD.—King Edward VI School, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Rationalized M.K.S. Units in Electrical Education," by Dr. E. Bradshaw.

Tuesday, 5th February

BRISTOL.—Electricity House, 7 p.m. I.E.E. Bristol Students' Section. "The Recurrent Surge Oscillograph and its use in the Design of Surge-Proof Transformers," by A. Bennett.

CAMBRIDGE.—Cambridgeshire Technical College, 6 p.m. I.E.E. Cambridge Radio Group. "Colour Television," by L. C. Jesty.

HAMMERSMITH.—Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Electrical Oils," by E. C. Montgomery.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "The Protection of Electrical Power Systems," by H. Leyburn and C. H. W. Lackey.

LIVERPOOL.—Merseyside and North Wales E.B., Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "Lighting of an Ocean Terminal," by H. S. Allpress.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "Economic Plant Sizes and Boiler Set Groupings on the British Grid," by B. Donkin and P. H. Margen.

Wednesday, 6th February

MANCHESTER.—Engineers' Club, Albert Square, 12.45 p.m. North-Western Fuel Luncheon Club. "Energy in the Future," by Prof. F. E. Simon.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. "Electrical Control of Dangerous Machinery and Processes: Part II Remote Supervisory Control," by W. Fordham Cooper.

NEWCASTLE-ON-TYNE.—Minor Durrant Hall, Oxford Street, 6.15 p.m. I.E.S. Newcastle Centre. "Illumination and Illusion," by P. Hartill.

SOUTHSEA.—Royal Beach Hotel, 6.30 p.m. I.E.E. Southern Centre. "A New Stroboscope for High-Speed Flash Photography," by W. D. Chesterman, D. R. Clegg, G. T. Peck and A. J. Meadowcroft. (Joint meeting with the Southern Branch of the I.Mech.E.).

WOOD GREEN.—Three Jolly Butchers Hotel, 8.15 p.m. A.S.E.E. North London Branch. "Supervisory Remote Control of Electrical Supplies," by J. F. Fletcher.

YORK.—Creamery Restaurant, Pavement, 7.30 p.m. A.S.E.E. York Branch. "Electrical Measuring Instruments and Industrial Metering," by J. Collinge.

Thursday, 7th February

CROYDON.—Café Royal, North End, 8 p.m. A.S.E.E. South London Branch. "General Installation Work with reference to Large Blocks of Flats," by J. W. Quelch.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. "The Economics of Low-Voltage Electricity Supplies to New Housing Estates," by F. G. Copland. (Supply Section paper.)

NOTTINGHAM.—E.M.E.B., Smithy Row, 5.30 p.m. I.E.S. Nottingham Centre. "Illumination of a Medium Size Factory," by W. K. Martin.

Friday, 8th February

BIRMINGHAM.—Imperial Hotel, Temple Street, 6 p.m. I.E.S. Birmingham Centre. "Industrial Lighting," by E. H. Norgrove.

BRISTOL.—Grand Hotel, 7.30 p.m. A.S.E.E. Bristol Branch. "Automobile Welding Repairs," by A. Gilliard.

LIVERPOOL.—Service Centre, Whitechapel, 7.30 p.m. A.S.E.E. Liverpool Branch. Lecture and film "Distinguished Company."

LONDON.—39, Victoria Street, S.W.1, 6.30 p.m. Junior Institution of Engineers. "Modern Submarine Cables," by E. A. Applebee.

NEWCASTLE-ON-TYNE.—Old Assembly Rooms, 7.15 p.m. I.E.E. North Eastern Centre. Annual dinner.

STOKE-ON-TRENT.—Copeland Arms Hotel, 7.30 p.m. A.S.E.E. Crewe Branch. "Industrial Lighting," by V. Heydon.

Purchasing Officers' Association

At a meeting of the East London Branch of the Purchasing Officers' Association held on 21st January at the Valentine Hotel, Ilford, Mr. P. A. Dunn (Aero Research, Ltd.), presented a paper on "Modern Synthetic Adhesives," followed by a lantern show.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 12th March from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1945

202[illegible]. Compagnie Générale d'Electricité.—Automatic switching system applicable to telephony. 5th November, 1945. (668261.)

1947

161[illegible]. Soc. Technique pour l'Industrie Nouvelle Soc. Anon. Stin, and Oehler, K.—Train control and cab signalling apparatus actuated inductively from the track. 21st June, 1947. (668264.)

17157. British Thomson-Houston Co., Ltd.—Cathode-ray tubes. 30th June, 1947. (668161.)

32174. British Thomson-Houston Co., Ltd.—Electronic high-frequency generators suitable for industrial heating. 5th December, 1947. (668271.)

1948

166. Bayard, H. M., and Roquet, R. J. C.—Apparatus for pre-correcting telegraph signals to compensate characteristic distortion in transmission over a line. 2nd January, 1948. Addition to 652601. Convention date not granted. (668272.)

742. Philips Electrical, Ltd.—Amplifiers incorporating electron-discharge devices, for centimetre wavelengths. 9th January, 1948. Cognate application 713, 13th January, 1947. (668162.)

6076. Standard Telephones & Cables, Ltd.—Electrical measuring device in which variable currents or voltages are converted into characteristic pulse trains. 27th February, 1948. (668164.)

9239. British Thomson-Houston Co., Ltd.—Automatic electric motor control systems. 1st April, 1948. (668165.)

9665. Philips Electrical, Ltd., Gentry, C. H. R., and Newson, D. W. S.—Electrical apparatus for chemical analysis. 9th May, 1950. (668166.)

10930. British Electrical and Allied Industries Research Association, Whitney, W. B., Briscoe, E. M., and Hudson, A. A.—Gas-blast electric circuit breakers. 11th April, 1949. (668276.)

12532. Murex, Ltd., and Garvin, S. J.—Sintered anisotropic magnets. 6th May, 1948. (668278.)

15151. Standard Telephones & Cables, Ltd.—Electron-discharge apparatus. 4th June, 1948. (668168.)

15158. Telefonaktiebolaget L. M. Ericsson.—Distribution networks particularly for telephone systems. 4th June, 1948. (668279.)

15360. Glover, D. W., and Lord, G. W.—Periodically-operating electrical switching apparatus. 7th June, 1949. (668067.)

16058. Aktiebolaget de Lavals Angturbin.—Combined gas and steam power plants. 15th June, 1948. Cognate applications 16059, 20th January, 1948, and 16060, 26th February, 1948. (668068.)

22108. Glover, D. W., and Lord, G. W.—Warning systems for electric motors. 9th June, 1949. (668074.)

33141. National Research Development Corporation.—Electrodeposition of tungsten. 23rd January, 1950. (668085.)

1949

1112. British Mechanical Productions, Ltd., and Osborn, F. T.—Electrical multi-contact socket outlets. 16th January, 1950. (668172.)

3191. Postmaster General.—Signalling receivers. 12th April, 1950. (668298.)

3460. Amplivox, Ltd.—Miniature telephone receivers. 16th January, 1950. (668173.)

5051. English Electric Co., Ltd.—Axle boxes for railway vehicles. 24th February, 1950. (668302.)

5987. Philco Corporation.—Radio apparatus. 4th March, 1949. (668306.)

7736. Superheater Co., Ltd., Small Electric Motors, Ltd., and Rudorff, D. W.—Apparatus for testing materials by magnetic or electrical analysis. 22nd June, 1950. (668177.)

9555. Electric & Musical Industries, Ltd.—Apparatus for the manufacture of bases for electron discharge devices and the like. 11th April, 1950. (668308.)

10605. Ferranti, Ltd., and Williams, J. R.—Gyroscope apparatus. 11th April, 1950. (668310.)

10691. Electric & Musical Industries, Ltd.—Deflecting circuits for cathode-ray tubes. 24th April, 1950. (668183.)

11832. Precision Developments Co., Ltd.—Variable resistances. 3rd May, 1950. (668185.)

12638. Egen Electric, Ltd., and King, A. E.—Variable resistances or potentiometers. 12th May, 1950. (668186.)

13263. Standard Telephones & Cables, Ltd.—Terminations for coaxial conductor communication cables. 15th May, 1950. (668312.)

13488. Lucy & Co., Ltd., W.—Electric circuit breakers of the airbreak type. 22nd May, 1950. (668314.)

17075. English Electric Co., Ltd.—Gas-blast electric circuit breakers. 23rd June, 1950. (668324.)

19104. Standard Telephones & Cables, Ltd.—Moisture measuring and controlling instruments. 14th July, 1950. (668196.)

19379. General Electric Co., Ltd., and Kirkness, R. H.—Thermionic valve amplifiers suitable for television apparatus. 24th July, 1950. (668197.)

20265. Compagnie Générale de Télégraphie sans Fil.—Very high gain travelling-wave valves. 3rd August, 1949. (668334.)

21166. Rotax, Ltd.—Battery charging systems. 6th September, 1950. Cognate application 29849, 22nd November, 1949. (668201.)

21373. Fletcher, J. J.—Guards for the cooking rings of electric and gas cookers and the like. 28th June, 1950. (667980.)

21648. Diamond H Switches, Ltd.—Mounting means for electrical switchboard or panel fittings and the like. 17th August, 1950. (668203.)

22224. Westinghouse Electric International Co.—Scanning devices for register regulation. 26th August, 1949. (668205.)

22372. American Phenolic Corporation.—Multiple lead transmission cables. 29th August, 1949. (668206.)

24276. Soc. Francaise Radio-Electrique.—Electric servo systems. 21st September, 1949. (668208.)

24748. Philips Electrical, Ltd.—Thermionic valve power amplifiers. 27th September, 1949. (668210.)

24933. Soc. Francaise Radio-Electrique.—Diversity receiving system for single-sideband signals. 28th September, 1949. (668211.)

25389. Dussik, F.—Ultrasonic sound generators. 3rd October, 1949. (668343.)

26644. Akt.-Ges. Kummler & Matter.—Overhead line switch for electrically-driven vehicles. 17th October, 1949. (667984.)

30470. General Electric Co., Ltd., Aspin, J. J. E., and Stove, J. P.—Relay station apparatus for use in telecommunication systems. 28th November, 1950. Addition to 660459. (668219.)

31021. Standard Telephones & Cables, Ltd.—Electron-image storage tube. 2nd December, 1949. (668352.)

32712. Borg-Warner Corporation.—Electrical cable connectors. 21st December, 1949. (668354.)

32716. Western Electric Co., Inc.—Electron-discharge devices. 21st December, 1949. (668355.)

1950

26. Allmanna Svenska Elektriska Aktiebolaget.—Electric warming elements. 2nd January, 1950. (668101.)

192. Triggs, W. W. (Edison, Inc., T. A.).—Portable electric battery. 4th January, 1950. (668102.)

385. Stenberg, S. L.—Electric lampholder. 6th January, 1950. (668104.)

516. Aversten, K. J.—Electric connection and method for producing the same. 9th January, 1950. (668109.)

1738. Soc. d'Etudes et de Recherches des Applications Mécaniques et Electriques.—Dynamo-driving arrangement with speed increasing means chiefly for bicycles, tandem bicycles and the like. 23rd January, 1950. (668120.)

2222. Lincoln Electric Co.—Electrode holder for arc welding. 27th January, 1950. (667867.)

2361. Aircraft-Marine Products, Inc.—Electrical spade type connectors. 30th January, 1950. (667869.)

2413. Marconi's Wireless Telegraph Co., Ltd.—Thermionic valve oscillators and selective amplifiers. 4th September, 1950. (668232.)

2776. Metropolitan-Vickers Electrical Co., Ltd.—Testing of electric switches and circuit breakers. 2nd February, 1950. (668138.)

2913. Landis & Gyr Akt.-Ges.—Magnet holder for magnets of high coercive force. 3rd February, 1950. (667877.)

3013. Kite, D. G.—Lighting systems for motor vehicles and the like. 6th February, 1950. (667880.)

3614. Philips Electrical Industries, Ltd.—Superheterodyne radio receivers. 13th February, 1950. (668238.)

3989. Philips Electric[al] Industries, Ltd.—Coated welding rods. 16th Febru[ary], 1950. (667905.)

4009. Berthiez, C. W.—Device for controlling the speed of the working motor in a Ward-Leonard system. 16th February, 1950. (668242.)

4331. Naamlooze Vennootschap Fabriek van Electrische Apparaten Voorheen F. Hazemeijer & Co.—High-power electric circuit breakers. 20th February, 1950. (668243.)

4415. Standard Telephones & Cables, Ltd.—Electrical measuring devices. 21st February, 1950. (667989.)

6730. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Receiving relay devices for remote control by modulated carrier currents. 17th March, 1950. (667999.)

7592. Westinghouse Electric International Co.—Dielectric heating apparatus. 27th March, 1950. (668248.)

8751. Metropolitan-Vickers Electrical Co., Ltd.—Electromagnetic wave-guides. 6th April, 1950. (668017.)

9220. General Motors Corporation.—Electric motors. 14th April, 1950. (668021.)

9487. British Thomson-Houston Co., Ltd.—Compressors particularly for refrigerators. 18th April, 1950. (668022.)

11786. British Thomson-Houston Co., Ltd.—Release and reset mechanism for clothes wringers. 11th May, 1950. (667918.)

12058. Armstrong, E. H.—Frequency modulation multiplex systems. 15th May, 1950. (668030.)

12181. Philips Electrical Industries, Ltd.—Illuminating devices. 16th May, 1950. (668032.)

12436. Willard Storage Battery Co.—Electric batteries. 18th May, 1950. (667920.)

12815. Siemens-Schuckert (Gt. Britain), Ltd., and Crocker, W. G.—Electric switches of the push-button type. 22nd May, 1950. (668037.)

13031. Mallory Metallurgical Products, Ltd.—Resistance welding apparatus. 24th May, 1950. (668038.)

13265. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Television or like systems. 26th May, 1950. (667928.)

13842. Western Electric Co., Inc.—Method [of] and apparatus for forming a sheath of strip material a[bout] a core. 2nd June, 1950. (667934.)

14361. Micafil, Ltd.—Machine for winding small [co]ils on rings with thin wire. 8th June, 1950. (668042.)

15274. British Thomson-Houston Co., Ltd.—Protective circuits for electrical windings. 19th June, 1950. (66[8]027.)

15378. Babcock & Wilcox, Ltd.—Tubulous [va]pour generators. 20th June, 1950. (667942.)

16384. Sperry Corporation.—Electromagnetic [wa]ve-energy transmission systems. 30th June, 1950. (6[68]051.)

16758. Allmanna Svenska Elektriska Aktiebol[aget].—Electric melting furnaces. 5th July, 1950. (667966.)

16903. Philips Electrical Industries, Ltd.—Electron-discharge tubes. 6th July, 1950. (668049.)

17835. Felten & Guilleaume Carlswerk, Akt.-[Ges.]—Electric high-tension pressure cables. 17th July, 1950. (668053.)

18435. British Thomson-Houston Co., Ltd.—[Sol]ders for ceramics. 24th July, 1950. (667895.)

18929. Mond Nickel Co., Ltd.—Welding electrodes. 28th July, 1950. (668054.)

19918. Philips Electrical Industries, Ltd.—Permanent magnets. 10th August, 1950. (668057.)

20137. British Thomson-Houston Co., Ltd.—Electric cooking ranges. 14th August, 1950. (668058.)

20227. Western Electric Co., Inc.—Asymmetric electrically-conducting devices. 15th August, 1950. (668059.)

20247. British Thomson-Houston Co., Ltd.—Methods of making three-phase magnetic cores. 15th August, 1950. (668060.)

20433. British Thomson-Houston Co., Ltd., and Fisher, T. W. C.—Magnetrons. 17th August, 1950. (668141.)

21048. Allmanna Svenska Elektriska Aktiebolaget.—Bridge for electrical measurement and indication. 25th August, 1950. (668142.)

21357. British Thomson-Houston Co., Ltd.—Capacitor winding machines. 29th August, 1950. (668145.)

21456. British Thomson-Houston Co., Ltd.—Oscillator synchronizing systems. 30th August, 1950. (668146.)

21960. British Thomson-Houston Co., Ltd.—Magnetic cores. 6th September, 1950. (668151.)

22312. British Thomson-Houston Co., Ltd.—Clothes washing machines. 11th September, 1950. (668154.)

23981. Liverpool Electric Cable Co., Ltd.—Electric cables. 30th September, 1950. (668160.)

25023. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Radar systems. 13th October, 1950. (668256.)

25758. Philips Electrical Industries, Ltd.—Starting and operating circuit arrangements for electric discharge tubes. 23rd October, 1950. (668258.)

26400. British Thomson-Houston Co., Ltd.—Methods of shaping vitreous tubes. 30th October, 1950. (668259.)

27391. British Electrical & Allied Industries Research Association, Whitney, W. B., Briscoe, E. M., and Hudson, A. A.—Gas-blast electric circuit breakers. 11th April, 1949. Divided out of 15036/48. (668359.)

28677. British Thomson-Houston Co., Ltd.—Two-temperature refrigerator cabinets. 23rd November, 1950. (668260.)

1951

5870. Compagnie Gén[érale] d'Electricité.—Automatic switching system applicable to telephony. 5th November, 1945. Divided out of 668261. (668360.)

Amended Specifications

621316. Sanders & Co. (Wednesbury), Ltd., W., & others.—Electrical fuses.

639641. Dehn, S. G. (Sunbeam Corporation).—Automatic electrically heated coffee maker.

649005. Roevac Metal Pressings, Ltd.—Electric toasters.

652730. Pirelli-General Cable Works, Ltd., & others.—Methods for improving the resistance of polyethylene-containing materials to ultra-violet light.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Bath.—11th February. City Council. Installation of electricity at Julian Road Flats. H. Robbins & Davies, architects, 7, Brock Street.

Belfast. — 25th February. City Council. 350 kW electrode steam boiler and ancillary equipment, at Laganbank Road disinfecting station. City surveyor, City Hall.

Bristol.—16th February. City Council. X-ray equipment. (See this issue.)

Bury St. Edmunds.—18th February. Corporation. Inspection and maintenance of electrical equipment and electrical installations in Council houses on Mildenhall Road Estate. (See this issue).

Egypt.—CAIRO.—5th April. Egyptian State Railways. Supply and erection of overhead equipment, control room and four substations, electric trains and electric signals for electrification of line between Cairo and Helwan. (C.R.E. 1036/52. Ten/3499.)*

Huddersfield.—13th February. Town Council. A year's supply of lamps (tungsten, mercury vapour and sodium) and cables. Borough surveyor, High Street Buildings.

Luton.—25th February. Corporation. Street lighting equipment. (See this issue).

Merthyr Tydfil.—14th February. Town Council. Electrical installations in nine schools. Town clerk, Town Hall.

New Zealand. — WELLINGTON. — 27th February. New Zealand Post Office. Wire and cable. (C.R.E. 2689/52. Ten/3517.)*

AUCKLAND.—31st March. Two 5,000 kVA regulating transformers for the Takanini substation. (C.R.E. 2791/52. Ten/3521.)*

Northumberland.—County Council. Installation of electric lighting in Hexham Grammar School.—County architect, County Hall, Newcastle-on-Tyne.

Poole.—19th February. Town Council. A year's suppiy of lamps, cables, fittings, water heaters and control units; street lighting lanterns, conduit and wiring accessories. Borough surveyor, Municipal Buildings.

Runcorn.—8th February. U.D.C. Electric lamps for one year. T. J. Lewis, Town Hall.

Towcester.—Parish Council. Fluorescent street lighting equipment. (See this issue.)

Uruguay. — MONTEVIDEO. — 14th March. Usinas Electricas y Telefonos del Estado. Transformer substation equipment. (C.R.E. 1005/52. Ten/3503.)*

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

ORDERS PLACED

Dudley. — Housing Committee. Recommended. Electrical installations in 224 houses at present supplied with gas (£5,064).—T. H. Priest & Sons, Ltd.

Inverness.—County Council. Recommended. Electrical installations in pre-war houses at Mallaig (£2,011).—Western Battery Service.

Leeds.—Corporation. Recommended. Electrical installation work at the Western sub-fire station (£1,047).—B.C.S. (Electrics), Ltd.

London. — SOUTHWARK. — Borough Council Works Committee. Recommended. Supply of 40 "Woolwich" type street lighting columns (£8 17s each).—Revo Electric Co., Ltd.

Nuneaton.—Education Committee. Recommended. Electrical installation at Caldwell School (£1,896).—F. Burton.

Rhondda.—U.D.C. Installation of electricity in 150 houses at Maerdy (£3,190).—South Wales Electricity Board.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Reconstruction of jam making factory, Steyne Road; Co-operative Wholesale Society, Ltd., 99, Leman Street, E.1.

Aldershot.—Flats (36), Denmark Street estate, North Town; F. W. Taylor, borough surveyor, Municipal Buildings, Grosvenor Road.

Atcham (Salop).—Houses at Bomere Heath, Minsterley, Buildwas, Church Preen and Pontesbury; J. R. Sockett, R.D.C. surveyor.

Barnsley.—Post-operative ward at Beckett Hospital; Hadfield, Cawkwell & Davidson, architects, 279, Glossop Road, Sheffield.

Bath.—Secondary modern girls' school, Larkhall; J. Owens, city engineer, Guildhall.

Bilston.—Houses (138), Bradley and Bradley Lane North; borough architect, 20, Wellington Road.

Birmingham.—Dwellings (72), Brandwood Park Road, Kings Heath; city engineer, Civic Centre.

Blackpool.—R.C. primary school, Stanley Road; Wm. Eaves & Co., Ltd., South Shore.

Bootle.—Assembly hall, gymnasium, dining rooms, workshops, laboratories, art and craft rooms, etc. (grammar-technical school), New Park Farm site, Bridge Lane, Netherton; W. A. Harrison, borough surveyor, Town Hall.

Bourne.—Block of flats, Austerby; U.D.C. architect, Bourne, Lincs.

Bristol.—Ward units and nurses' home at Hortham Colony, Almondsbury; South Western Regional Hospital Board, 2, Elton Road.

School, Southmead estate; city architect, Eagle House, Colston Avenue, 1.

Burgess Hill.—Dwellings (24), St. Andrew's Road site; F. E. R. Hogg, U.D.C. surveyor, 32, Church Road.

Burnley.—Crematorium; Taylor & Young, architects, 195, Oxford Road, Manchester.

Cardiff.—Technical college, Llandaff; L. C. Patterson, architect, 11, Cathedral Road, Cardiff.

Castle Ward.—Houses (200), Dinnington Colliery; surveyor, R.D.C. offices, Ponteland, near Newcastle-on-Tyne.

Cheshire. — Secondary modern schools at Neston and Little Sutton, grammar school at Dukinfield, and first section of college of further education, Altrincham-Sale; county architect, The Castle, Chester.

Clitheroe.—Flats (44), Low Moor estate; Sefton Building Co., Ltd., 24, Fenwick Street, Liverpool.

Coseley.—Dwellings (60), Woodcross estate; J. C. Roper, clerk to U.D.C., Council House, Coseley, Bilston.

Coventry.—Howes Infants' School; Hellberg & Harris, architects, 13, Queen Victoria Road.

Crawley.—Works, new town industrial area; W. Edwards & Co. (London), Ltd., Worsley Bridge, S.E.26.

Printing works; Lloyd's Register Printing House, 64, Southwark Street, London, S.E.1.

Crewe.—Operating theatre and extensions to kitchen, Memorial Hospital (£30,528); T. Duffy, architect to Manchester Regional Hospital Board, Sunlight House, Quay Street, Manchester, 3.

Dagenham.—Service pump house and electric substation; May & Baker, Ltd., Rainham Road South.

Darlington.—Houses (90), Haughton South; borough architect.

Dartford. — Technical college (first stage £200,000) for Kent E.C.; Wm. F. Blay, Ltd., builders, Spital Street.

Doncaster.—Block of 20 flats opposite Royal Infirmary; borough architect.

Alterations and additions at Rossington Hall Special School (£46,341); Fred Pearson & Co., 32, Cemetery Road, Doncaster.

Dudley.—Flats (60), Paradise Road and Belper Row; borough architect.

Durham.—College for further education and community centre at Ferryhill; county architect, Court Lane, Durham.

Eastbourne.—Research laboratories, Brampton Road; Armour & Co., Ltd., 2, Lindsey Street, E.C.1.

Eccles.—Works extensions; L. Gardner & Sons, Ltd., Barton Hall Engine Works, Garton Street.

Five shops with flats, Exeter Avenue; C. Musker Bros., Ltd., Bingham Street, Swinton.

Erith.—Dwellings (52), Matfield Road estate; borough engineer.

Friern Barnet.—Works and offices, Colney Hatch Lane; Robert Deards, Ltd., East End Road, N.3.

Hull.—Reconstruction of prison, Hedon Road; Stepney Construction, Ltd., builders, Grovehill, Beverley.

London. — WANDSWORTH. — Dwellings (48), Southfields; Donald Hamilton, Wakeford & Partners, architects, 7, Connaught Place, W.2.

WESTMINSTER.—Office block, Dean Farrer Street; Tothill Press, Ltd., 33, Tothill Street, S.W.1.

Manchester.—Home for the aged at New Moston and permanent library on site of Hulme Town Hall; city architect.

Three-storey office and warehouse at Styal Road, Moss Nook, Wythenshawe, for Renold & Coventry Chain Co., Ltd.; Cruikshank & Seward, architects, 16, Princess Street, Manchester.

March. — Further houses and bungalows, Badgeney-Deerfield estate; W. S. Pickett, U.D.C. architect, March, Cambs.

Meriden. — Houses (52), Nuneaton Road, Arley; B. L. Stephenson, R.D.C. surveyor, The Old Vicarage, Coleshill.

Mexborough.—Adaptations at Montagu Hospital; J. Totty & Co., architects, Imperial Buildings, Rotherham.

Nantwich.—Hostel block at Wrenbury Hall Colony; E. Mainwaring Parkes, architect, Shipgate Street, Chester.

Newport (Mon.).—Flats (126), on sites at Gaer and Malpas; T. F. Howells, Ltd., builders, Bartlett Street, Caerphilly.

Surbiton.—Flats (32), Lovelace estate; W. J. Simms, Sons & Cooke, Ltd., builders, 78, Mount Street, W.1.

Factory, Cox Lane; Kingston Instrument Co., Ltd., 16, St. James's Road.

Swansea.—Showrooms and offices, The Kingsway, for Daral Fabrics; C. G. Vaughan, architect, 1, St. James's Gardens.

Swindon.—Factory, Spring Gardens; Garrard Engineering & Manufacturing Co., Ltd., Newcastle Street.

Watford.—Partial rebuilding of works; Watford Screw Works, Ltd., Woodmans Yard, High Street.

Works extensions; Penfold Fencing, Ltd., Balmoral Road.

West Bromwich.—Houses (72), Appleton Avenue; W. J. Cale, 6, Easy Row, Birmingham.

West Hartlepool.—Bottling factory, Stranton, for J. W. Cameron & Co., Ltd.; E. M. Lawson, architect, Barras Buildings, Newcastle-on-Tyne.